School of Social Science

PhD Business Management

C119-MAN Management, PhD

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Sense-making Strategies: the role of intermediaries in university technology transfer environment.

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Word count: 79,219

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H00173712

2019-09-10

Abstract

The context of this research project is the field of university technology transfer. There is a growing body of literature that states discourse between academic and industry partners is problematic in nature. In order to investigate this, the theoretical lens of sense-making was utilized to explore the field of technology transfer and to examine the strategies used to communicate between Technology Transfer Offices (TTOs) (along with their staff members), academics, and industrial partners as they try to work together, along with understanding this commercialization process using sensemaking theory. Furthermore, the thesis seeks to further enhance knowledge of the commercialization process by improving communication strategies for those individuals and groups involved. In order to achieve this aim an ethnographic exploratory case study was undertaken at a university technology transfer office. The information that was gathered from the exploratory study became the basis for the interviews, which proceeded for the remainder of the data collection. The interview process included 16 interviews from 13 universities in Scotland.

The findings of this study relate to sense-making theory by introducing the TTO employee as a mediator and examining the role of the TTO employee in facilitating the sense making process. The findings illustrate how someone who is not an expert in the field can add to the sense-making process even though they (the TTO employee) are not actually making sense, rather facilitating the discourse in such a way that sense can be made. This is the process of dumbing down the information. The findings contribute to the body of knowledge both theoretically and contextually and specifically contribute to sense-making theory by examining how the TTO employee deliberately stops the sense-making process in order to make sense of the discourse that is being communicated by the other groups involved.

The contextual findings relate to the university technology transfer industry by emphasizing who the TTOs work with, both internally within the university and externally outside of the university. The findings have shown that there seems to be very little awareness of the TTOs' services in both the academic and industry communities. This is contradictory to the literature which is discussed in chapter 2 and chapter 5. Additionally, the findings place emphasis on a background problem pertaining to the problematic discourse between academics and industry, which could affect the potential outcome of a commercialization project.

Dedication

I dedicate this thesis to my wife to be Sheena, my parents Joe, Janette and Katie, my sponsor Troy, my sponsees Karen, James and Hammish and friends Rafal, Stephanie, Ricky and Dave. Your love and support have helped me get through this experience.

Acknowledgements

The completion of this thesis would not be possible without the heartfelt support of many people. Firstly, I would like to convey my deepest appreciation to my supervisors Professor Robert MacIntosh and Dr. Yvonne McLaren-Hankin, for their excellent supervision and constructive feedback. Thank you both for your invaluable advice and guidance. Thank you, Robert, for your professional mentoring and for going well beyond your duty.

Equally strongly, I would like to thank Stephanie and Rafal for their advice, assistance and enduring tolerance of different bumps on my PhD path. Countless board games and lively discussions with Stephanie and Rafal turned a challenging time in Edinburgh into a fantastic adventure. You were the best friends and roommates for this journey that I could wish for.

I would like to thank my parents Joe, Janette and Katie, my soon to be wife Sheena, along with her family for their continued support, love and understanding during this time in my life. Additionally, I would like to thank my fellowship for letting me vent and hearing my ramblings for several years during this process. The journey would not have been accomplished without all of you.

My sincere gratitude also goes to Professor Umit Bititci, Dr. Norin Arshed, Dr. Julie MacFarlane, Dr. Kate Sang and the rest of the academic and support staff at Heriot-Watt for helping along the way, believing in me to teach their classes along with many other responsibilities throughout the university. I would also like to thank the School of Social Sciences, Heriot-Watt University, for funding this research project, and for providing a supportive learning and working environment.

I must also convey special thanks to my anonymous research participants. They had nothing to gain by helping a stranger and a lot to lose. The private time and energy, which they donated for this project, for many of them, was a scarce resource. I deeply appreciate your help and good will. Without your kind assistance, I would not be able to complete this project.

Finally, I have a personal debt of gratitude to the amazing PhD community at Heriot-Watt. Thank you for your friendships.

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Chapter One: Introduction

The introduction chapter contains 3 main sections illustrating the basis of this research project. The first section describes the basic context of the thesis which is the university technology transfer industry. Furthermore, discourse is discussed as part of the context used to underpin the theoretical lens (sense-making theory), which is to understand how technology transfer office (TTOs) employees make sense of different discourses used by academics and industry partners. The second section of the introduction describes the aims and objectives of the thesis. The third and final section of the introduction explains the thesis structure. This includes the research context and theoretical lens; methodology; findings and analysis; discussion and conclusion.

1.1 Research Context and Theoretical Lens

The research context of technology transfer was chosen because TTOs are seen as a dual agent (Siegel et al., 2007), acting as an intermediary between university staff members and industry and whose job it is to generate a wealth of commercial knowledge in order to build and increase the reputation of the university (Macho-Stadler et al., 2007). The role of the TTOs and their staff members is typically to act as the commercialization centre for all university-based projects. This includes aspects of governmental funding, research output (such as publications), licensing, patenting and the creation of spinout companies. Therefore, because of their job role, TTOs and their employees are in constant contact with both academics and industry partners. Furthermore, because of the complex nature of the university technology transfer environment and the considerable amount of people TTO employees need to communicate with on a regular basis, a rather unique opportunity was provided in order to research how people communicate with different groups.

It has been argued by Fincham and Clark (2009), that discourse between academics and industry partners can be problematic, which is why one of the main aims is to understand how employees in TTOs can help facilitate the discourse between these individuals, thereby creating a mutual understanding and leading to a successful commercial output. Within this research context, university TTOs are considered to be specialized groups or units of individuals based within a university to help commercialize and manage all aspects of intellectual property (IP) such as patenting, creating licensing agreements and spinout companies, along with performing market analysis and economic assessments of various industries. Traditionally, TTOs have placed an emphasis on licensing and patenting but in more recent years increased the creation of spin-off companies (Thursby and Thursby, 2007). The activities of the TTOs have important

economic and policy-making implications because licensing agreements and spinoffs creation can result in more income for the university (Siegel et al, 2007).

Ultimately, there are multitude of different ways in which people can communicate with one another in both everyday situations and in the technology transfer environment such as face-to-face communication, telephone conversations, web conferencing, email, verbal, non-verbal and many other forms of discourse. In order to improve understanding of the different ways in which people and groups can communicate, discourse is used as a conceptual term to incorporate the various styles and types of communication.

Additionally, discourse should be understood within an organizational context, in this case where TTOs, academics and industry partners all work for different organizations and all have different discourses and ways of communicating within their own organizations let alone across those organizations. Therefore, communication can become problematic because the discourse, or the way of communicating, is different than the individuals in the commercialization process. Understanding organization discourse will allow for an understanding of structured gatherings of texts used by different individuals and group members. Hardy and Phillips (2009: 300) argue that discourse in an organizational context is defined as "structured collections of texts, and associated patterns of textual production, transmission, and consumption, located in a historical and social context". Therefore, one of the main aims of this project is to understand how TTOs help individuals from different organizations or groups engage with each other's discourses.

The theoretical lens in which the context is examined is through sense-making theory. Sense-making theory is based on people's innate desire to try and understand the world around them. Therefore, sense-making becomes the basis for understanding the individual accounts involved in the process based on their understanding and is an continuing process as people involved in the process try to make sense of change as it is happening (Gioia and Thomas, 1996; Gioia and Chittipeddi, 1991). Sense-making is based on identity construction, which means the identities of people involved in a specific context shapes how those individuals view the world (Pratt, 2000; Thurlow and Mills, 2009; Weick, et. al., 2005; Currie and White, 2003). Furthermore, sense-making is a social process, which is simultaneously an individual and collective experience, representing "an evolving product of conversations with ourselves and with others" (Currie and Brown, 2003: 565). Henceforth, sense-making is the theoretical perspective which underpins this thesis because it is the most applicable theory to try and understand

how TTOs make sense of different discourses with the purpose of commercializing university-based intellectual property.

1.2 Research Aims and Objectives

By adopting sense-making theory as the overall theoretical viewpoint to focus on and help guide this study, certain theoretical concepts and relationships have shaped the conceptual framework of this research and the questions it seeks to address. The overall aim of this thesis is to explore the field of technology transfer and to examine the strategies used to communicate between TTOs (along with their staff members), academics, and industrial partners as they try to work together, along with understanding this commercialization process using sense-making theory. Furthermore, the thesis seeks to further enhance knowledge of the commercialization process by improving communication strategies for those individuals and groups involved. Additionally, the research methodology will help to explore the objectives of the thesis. The objectives of the thesis are as follows:

i. To identify the role of TTOs in the commercialization process and the key issues they face in the conduct of their work with academics.
ii. To understand sense-making strategies pertaining to the technology transfer environment.
iii. To understand how different discourses shape communication between TTO employees, academics and industry.
iv. Examine the roles of TTOs as mediators during the process of sense-making.

1.3 Thesis Structure

This thesis is divided into seven chapters. In order to complete the aims and objectives of this project the remainder of the thesis is structured as follows:

1.3.1 Chapter Two: Literature Review

The second chapter of this project provides the literature to understand the context in which the research was conducted, along with the theoretical lens which underpins this study. The overall research context for this thesis concerns the university technology transfer industry. Many of the authors used in this section are older publication dates because, after the formation of the Bayh-Dole Act (United States) in the 1980s, there was an abundance of publications pertaining to the subject of technology transfer in the mid to late 1990s (i.e. Howell and McKinlay 1999, Charles and Howells 1992). Additionally, since then, many European countries have adopted similar legislation, which led to a further resurgence of literature in the early 2000s (i.e. Segal et al. 2008, Lockett et al

2002, Huggins and Kitagawa, 2012). These sources and references remain highly relevant to today's research and are still cited on a regular basis.

This chapter explores what a technology transfer office is, followed by the rationale for universities to have a highly specialized group of individuals whose job it is to commercialize the university's intellectual property. The next section of the chapter focuses on the success of TTOs in the United States of America and how the idea of university commercialization spread throughout Europe. Since the context of this research is focused in Scotland, which is part of the United Kingdom, the UK technology transfer environment is explored, along with the commercialization industry in Scotland. The last section of this chapter will examine the key differences between the US and the UK technology transfer environment.

The next section of the literature review pertains to the concept of discourse. In order to better understand the different ways in which people communicate, discourse is examined as the overall theoretical mechanism in which communication is achieved in the first portion of the literature review. For the purposes of this thesis discourse is used as a blanket term that covers all aspects of communication, including verbal and non-verbal types of communication. In this chapter there is an introduction to discourse followed by its various definitions. To better understand the different modes in which individuals and groups can communicate with one another, organization discourse is studied in detail because TTOs, academics and industry partners all represent different organizations that have to successfully communicate with one another in order to commercialize their intellectual property.

In the next section of the literature review sense-making theory is discussed because it is the theoretical viewpoint in which the framework and the concepts of this thesis are derived. This portion of the literature review first looks at sense-making theory as a whole and what sense-making theory actually consists of. This is followed by sense-making and how it relates to discourse. The next part of the chapter examines the process of sense-making and relates to how, as people, we make sense of the unknown. Furthermore, this portion of the literature review examines various nodes of sense-making and different modes of sense-making. Additionally, this thesis identifies TTOs as mediators and as the individuals who are unknowingly practicing the various nodes and modes of sense-making during the commercialization process. Lastly, gaps in the literature are identified along with the aims and objectives of the thesis.

1.3.2 Chapter Three: Research Methodology

The research methodology chapter has been broken down into several sections. The first section pertains to the philosophical perspectives of this project which are examined in order to define the beliefs of the author, along with how the data will be collected and interpreted. Different philosophical paradigms are explored, various epistemological standpoints are studied, and different ontological perspectives are discussed in detail. Furthermore, this thesis builds theory inductively versus deductively, which has led to the identification of gaps in the literature.

Following the philosophical standpoint, the advantages and limitations of conducting qualitative research have been examined in this section of the methodology chapter. Additionally, ethnography is reviewed as an exploratory case study was undertaken at a higher education establishment in Scotland. This exploratory study was conducted for three weeks where observation of several members of a TTO were undertaken and over 20 people were ethnographically interviewed. Field notes, interviews and coding were examined in order to better understand how the data were analysed through thematic analysis. The information that was gathered from the exploratory study became the basis for the semi-structured interviews, which proceeded for the remainder of the data collection. The interview process, which lasted several months depending on participants' scheduling, included 16 interviews from 13 universities in Scotland. Additionally, the advantages and limitations of the ethnography and interviews were also reviewed.

In the next section of the research methodology chapter, grounded theory methods are discussed because they were used to analyse the data and to build on the sense-making theory. Different types of coding in relation to grounded theory methods are discussed, along with various beliefs (Glaser versus Strauss) of how grounded theory should be conducted. In addition, software such as NVivo were examined as that is the software used in order to organize the data for analysis. Lastly, the limitations of the study are addressed.

1.3.3 Chapter Four: Findings and Analysis

Interviews were conducted with TTO staff members from several HEIs (Higher Education Institute) in Scotland and were coded using grounded theory methods (see chapter 3 section 3.20.1). Several rounds of coding were undertaken as a way to generalize and become more intimate and familiar with the data, which is recommended by the leading academics in grounded theory methods (Charmaz, 2014; Charmaz, 2006; Glaser, 1978). The codes were based on the data provided by the respondents. The last

finding of this chapter is the development of a model that is used to build relationships between individuals in the commercialization process. This model is called the RRB model.

1.3.4 Chapter Five: Discussion

This chapter is divided into several sections and reviews the aims and the objectives of the thesis. This chapter in particular relates the findings that were reported in Chapter Five to the research context and the theoretical literature which was reviewed in Chapters Two and Three. The discussion is supported by the academic literature which contributes to the contextual literature by addressing who TTOs work with, awareness of TTO services (from the perspective of academics) and problematic discourse between academics and industry partners. The discussion is supported by the academic literature, which contributes to the theoretical literature by examining how TTO employees make sense of the conversation by dumbing down the information. It further contributes to theoretical literature by identifying TTOs and their employees in practicing various nodes and modes of the sense-making process.

1.3.5 Chapter Six: Conclusion

This chapter is the conclusion to the thesis. It begins by reviewing the thesis aims and objectives followed by reviewing the contribution to the research context, theory and management practice. The next section of the conclusion chapter re-examines the research methodology. Furthermore, the conclusion chapter addresses the limitation of the study and examines further implications for future research. The chapter also provides a personal reflective outlook of the chapter and a final conclusion for the thesis.

Chapter 2: Literature Review

2.1 General Introduction to the Research Context and Theoretical Positioning

Alvesson and Sandberg (2011), suggest that initial research questions are often formulated by means of gap spotting and less often by a systematic literature review. Alvesson and Sandberg (2011: 250) go on to further explain that scholars should engage in gap spotting since this will allow them to make the argument in order to contribute to the literature by "filling an important gap in the literature." Despite the allure of "gap-spotting", others argue that there is much more to the development of research questions than this, e.g. research questions are considered "a beginning point" for research (Agee, 2009: 431)." This is why MacIntosh et al. (2016) and Bartunek (2008) argues that research questions are likely to change during a field-based research project, especially when some of those involved in the research project including participants in the research setting, have a personal stake in the project. Additionally, MacIntosh et al. (2016: 13) further states:

> Research involves a considerable level of dialogue between those in a particular field-based situation and those hoping to study that situation in a way that contributes to improving the situation as much as it focuses on making a conceptual contribution.

For these reasons illustrated by Alvesson and Sandberg (2011); Agee (2009); Bartunek (2008); and MacIntosh et al. (2016) the research questions for this thesis do evolve as a result of both a review of the literature and an assessment of methodological issues. This is signposted clearly to the reader en route.

This literature review will cover a range of topics that are necessary to help define and shape the aim of this thesis, which is to explore the field of technology transfer and to examine the strategies used to communicate between TTOs (along with their staff members), academics, and industrial partners as they try to work together. The main aim of the thesis is to understand this process (known as the commercialization process) using sense-making theory. Furthermore, the thesis seeks to further enhance knowledge of the commercialization process by improving practice for those individuals and groups involved. Additionally, the literature review will help to explore the first version of the objectives (which have been mentioned in chapter 1 section 1.2) of the thesis, which are:

i. To identify the role of TTOs in the commercialization process and the key issues they face in the conduct of their work with academics.
ii. To identify the theoretical gap in sense-making strategies pertaining to the technology transfer environment.

iii. To understand how different discourses shape communication between TTO employees, academics and industry.

iv. Examine the roles of TTOs during the process of sense-making.

The first section of the research context portion of the literature review is separated into two main sections. The first section will examine the role, concept and field of technology transfer in order to show the rationale behind having an office that specializes in commercialization activities at a university. Furthermore, in this thesis, TTOs are conceptualized as an intermediary between university research staff, university administration and potential partners (firms, entrepreneurs, venture capitalists, etc.) that might want to commercialize IP. This viewpoint is based on the Siegel et al. (2007) explanation of TTOs. Additionally, a brief historical overview of how TTOs started in the United States and how the concept was spread throughout Europe will also be discussed. Also, a broad overview of the United Kingdom technology transfer environment, along with technology transfer within Scotland, will be examined. Lastly, this chapter will cover some key differences between TTOs in the US and the UK.

The second section of the research context examines the concept of discourse, as both academics and industry partners use different types of discourse throughout the commercialization process and often have issues communicating with one another. TTO employees often act as mediators between the two groups by helping to facilitate a mutual understanding of discourse used by either of the groups involved in the commercialization process. Furthermore, organizational discourse is covered to help identify what discourse is and how individuals from different organizational backgrounds can communicate with one another. In particular, different domains such as conversations and dialogue, narratives and stories, rhetoric and tropes are discussed because these are a variety of different ways in which TTO staff members can help make sense of different discourses.

In the third section of the literature review sense-making theory will be discussed because TTOs need to make sense of the different discourses used throughout the commercialization process. This section will explain what sense-making theory is and how sense-making can be used to help understand discourse. Furthermore, the process of sense-making will be covered which includes noticing and bracketing, labelling and categorizing, how sense-making is done retrospectively, making assumptions, how it is a social process and how it revolves around discourse. Additionally, the concepts of sense giving and sense breaking will be examined, along with the idea of mediated sense-making.

Lastly, in section four the conclusion will summarize the main points of the literature review and identify key gaps in the literature. Furthermore, the aims and objectives of this project will also be discussed in order to further explain the direction of this thesis.

2.2 Research Context: What is a Technology Transfer Office?

The primary duty of many universities is to engage in research and facilitate knowledge and information to both academic and student populations. The importance of this task on behalf of the university is well documented (Bok, 2003; Geisler, 1993; Newman, 1854). Universities can also help in technology transfer activities by providing research and development (R&D) projects, by assisting in patenting and licencing innovations along with establishing spin-outs and start-up companies, all of which can provide staff and students with the tools needed to become highly skilled individuals (Roberts and Malone, 1996; Smilor et al., 1990). According to Segal (1986), universities not only provide specialized expertise for faculty members, but their students also acquire knowledge through learning and living on the campus. Rogers (1986) supports this view and suggests that universities influence the innovation process through a variety of different ways, such as: scientific publications that collaborate with industry firms; training engineers and natural scientists; training PhD students by providing background knowledge, skills and personal networks; along with participating in informal networking; joint R&D projects between the university and the firms; research funding; and contract research with a goal of sharing and developing knowledge. Universities place a strong emphasis on training academic researchers and students which in turn build knowledge. The indirect benefits of training students and staff along with building knowledge become the main outputs of academic research into industry (Bok, 2003; Mansfield and Lee, 1996).

TTOs are a specialized group or unit of individuals based within a university to help commercialize and manage all aspects of IP such as patenting, creating licensing agreements and spinout companies along with performing market analysis and economic assessments of various industries. According to Bennetzen and Moller (2013), a TTO can provide research for a solution to non-existing or existing problems along with providing insights into products that the marketplace does not know it needs. Furthermore, they argue that TTOs also investigate the novelty and patentability of the intellectual property (typically done by external patent attorneys), market research (understanding customer needs, mapping competitors, stakeholders, etc.) and competitive intelligence (the

assessment of emerging technologies and alternative solutions that might compete with those being pursued by other universities and industries).

TTOs help facilitate commercial knowledge transfers of IP created from university research by licensing them to existing firms or start-up companies. The activities of TTOs have important economic and policy implications because by creating licensing and patenting agreements combined with the generation of university-based start-ups (spinoffs) can result in additional income for the university (Siegel et al, 2007). Furthermore, by increasing additional R&D for the universities helps to create employment opportunities for university-based researchers and graduate students. Thus, generating a spill over effect both economically and technologically into the surrounding geographic location from the university.

Traditionally, TTOs have placed an emphasis on licensing and patenting. However, in more recent years TTOs and their employees have increased efforts into the creation of spin-off firms (Thursby and Thursby, 2007). According to Siegel et al. (2007), much of the information pertaining to TTOs' have focused on the performance by examining elements of technology commercialization (such as licensing and patenting) and entrepreneurship (creating spin-out companies). For example, Siegel et al. (2007) states authors like Thursby and Thursby (2007), have studied university faculty involvement in technology commercialization, such as the inclination of academics to patent, disclose inventions, co-author with industry scientists, and form university-based start-ups. Furthermore, Thursby and Thursby (2007) and Siegel et al. (2007) have discovered that academics are rarely trained in these activities, let alone trained in the ability to perform a market analysis or foster business development, since these are not generally seen as key aspects of the researcher's training. Additionally, Bennetzen and Moller (2013: 12) argue "this points toward a pivotal role for TTO units, they are dedicated to facilitating and managing the process of making academic research have a direct impact on society."

2.3 What is the rationale and need for a technology transfer office?

Having a specialized unit such as a TTO can be beneficial for both the university and individual academic researchers. Not only can this office help facilitate the growth of university-developed technology, it can also act as a mediator between the goals and expectations of the university administration and the needs of academic researchers. There are several different rationales for the growth of TTOs within universities.

First, TTOs help bring knowledge created by academics together within the institution. Thus, by bringing together these inventions it creates a wealth of potential

commercial knowledge in order to build and increase the reputation of the university (Macho-Stadler et al., 2007). Second, those employed in TTO roles act as intermediaries between university academic staff and industry, which is the fundamental concept for this thesis. The majority of the sense-making literature focuses on an individual involved in the sense-making process and how they make sense of the information. The idea of intermediaries helping facilitate the act of making sense to other individuals is underdeveloped in the sense-making literature. Therefore, by studying those employed in TTO roles this thesis creates an opportunity to explore this intermediary role in the technology transfer environment and this is crucial in helping to frame the research questions outlined for this thesis along with making a contribution to sense-making theory by introducing mediated sense-making to the process of sense-making outlined by Weick et al. (2005) in chapter 2 section 2.11.3 of the literature review.

Jensen et al. (2003) describe the process of academic disclosure and university licensing being seen as a game, in which the goal from the university administration, the academic researchers and TTOs is to commercialize as much IP as possible. Furthermore, Siegel et al. (2007) explains that individuals who specialize in technology transfer treat the office as a dual agent. This means the technology transfer office is a representative of both research staff and the university. Siegel et al. (2007) also state that the university administration has the ability to influence and provide incentives to both the TTO and faculty members by establishing university-wide policies for the sharing of licensing income and/or sponsored research.

Furthermore, if an invention is disclosed by a university researcher, the TTO decides whether or not to search for a potential business to license the technology and then negotiates the terms of the licensing agreement with the possible firm. The quality of a product, along with the invention's potential to possibly be commercialized, are two of the most significant determinants of whether an invention becomes a licensed or patented technology. Siegel et al. (2007: 644) state that "TTOs engage in a short 'balancing act', in the sense that they can influence the rate of invention disclosures, evaluate the inventions once they are disclosed, and negotiate licensing agreements with firms on behalf of the university administration and faculty members".

Hellman (2007) describes further rationale for creating a technology transfer office is that the TTO has an advantage because it is a team of individuals who specialize in commercialization activities when compared to individual scientists that mostly teach or conduct research but do not specialize in establishing businesses or commercial activities. Additionally, TTOs are generally better equipped, trained and know how to

search for potential buyers that might be interested in licensed university technology. Hellman (2007) further argues that university researchers are more likely to delegate their search for potential buyers to TTOs when patent protection is implemented. Similarly, Hoppe and Ozdenoren (2005) explore the idea that TTOs act as innovation intermediaries in order to reduce any uncertainty problems. They suggest that firms seek to capitalize inventions; however, they cannot estimate the value of the technology with any form of certainty. Intermediaries like TTOs are able to make the investment less risky for the university. They do this by acquiring the expertise to locate new creations by inventors, sort the level of profitability or lack thereof and assess the efficiency level of potential commercialization activities.

TTOs are needed in order to make decisions about the commercialization process of IP because the university administration or research staff members are generally not able to focus their entire attention to commercialization activities. Siegel and Phan (2005) state that TTOs are constantly deciding how to strategically commercialize the IP created by university researchers; specifically, concerning whether emphasis should be focused on licensing or creating spinoff companies. These choices are mostly determined by the TTOs' perceptions of the relative financial returns and the universities' desire to generate economic/knowledge spill over to the local community. For example, Heriot-Watt University's strategic plan from 2013 – 2018 states (Heriot-Watt University, 2018):

> Research at Heriot-Watt spans the fundamental to the applied, through an interdisciplinary approach to knowledge creation and enterprise. This is strengthened through strategic collaborations and alliances with: other internationally leading universities and research institutes throughout the world; and business, industry and public-sector users of the University's range of research outputs or knowledge exchange.

Henceforth, why Lockett et al. (2005) argues, TTOs have expertise in both identifying opportunities for commercialization and developing spinoff companies because of their commercial networking and business development expertise. However, academic researchers can play a pivotal role, especially if their experience and knowledge is necessary for further development of the technology. Additionally, they can share their preference between creating a spinoff company and a licensing agreement (Lockett et al., 2005).

However, other literature from Nelsen (1998) and OECD "2002) suggests that TTOs, mainly in the US, may not be as efficient as previously alleged. Simply because a university may have and employ a TTO does not mean the office will succeed in securing

a positive net income from their intellectual property Moreover, according to Macho-Stadler et al. (2007), an AUTM (Association of University Technology Managers) report which represents all US universities with TTOs, collected data from 113 US universities. They discovered that a TTO size has a direct effect on licensing activity and licensing revenue. Macho-Stadler et al. (2007) further state that evidence based on interviews with five major US research universities concerning the organizational practices that would increase the productivity of TTOs which include the universities' royalty and equity distribution schemes combined with the quality of the TTO staff members. Thus, by mixing lawyers, scientists and entrepreneurs/businesses it served as a way to connect firms to scientists. Friedman and Silberman (2003) use the same AUTM data to explain significant factors pertaining to TTO outputs which include how many years the TTO has been operational, the regional location of the university, and if the university possesses a clear mission to support technological transfer and, often, greater rewards for faculty involvement. Furthermore, Thursby et al. (2001) links the size of the TTO (in terms of number of staff members) with the number of inventors' disclosures, and whether or not there is a medical school.

It is difficult to decipher what affects TTO performance and, more specifically, does a university's prestige have an influence on the potential economic commercialization of inventions, along with productivity of the TTO. For example, Sine et al. (2003) explain that both the effects of past licensing performance along with institutional prestige have an impact on the number of licenses issued by the university. A university's prestige which is measured by numerous official ranking criteria, can improve the perception of expected outputs pertaining to the potential licenses issued by the TTO. Furthermore, Chukumba and Jensen (2005) find that, beyond size (in terms of number of disclosures), the age of the TTO, royalties from licensed IP, as well as the quality of the faculty members, significantly influences licensing activities from the university's TTO. Additionally, because measuring success is subjective for each individual university, the concept can be problematic for scholars and universities alike. However, this thesis suggests that success of a university TTO should be measured on the number of IP generated, spinout companies created, and other measures used by the individual universities, relative to the HEI's size and number of staff in their TTOs.

2.4 Success of TTOs in the US and how the idea spread to Europe

This next section of the chapter will explain how the technology transfer industry in the US became a success in building TTOs, creating spinoff companies and increasing revenue for the universities, along with job creation. Following the success of TTOs in

the 1980s through legislation passed by the United States Congress, several European countries decided to follow with their own versions of the legislation in an attempt to commercialize university IP. Furthermore, an examination of the United Kingdom's technology transfer field will be provided. This section will also examine the key differences between the technology transfer environment between the United States and the United Kingdom.

2.4.1 TTOs in the US

The US version of technology commercialization is based on an entrepreneurial university model, which means to engage in technology transfer through patents and creating spin-out companies (Etzkowitz, 2002). The Bayh-Dole Act created by the United States Congress in 1980 has helped shape the commercialization of knowledge industry in the US. After the passage of the Bayh-Dole Act, many universities within the US increased their efforts in technology transfer, licensing, investments in new firms and the development of spin-out companies. Throughout the next 20 years, several universities licensing agreements increased eightfold, additionally patents increased fourfold (Mowery and Shane 2002). For example, the number of universities that created technology transfer offices increased from 20 in 1980 to 200 in 1990, and by 2000 nearly every research university had a TTO located on the campus (Colyvas et al., 2002). Furthermore, licensing of new technologies has increased almost two-fold since 1991. Annual streams of revenue accruing from these licenses have risen from about $160 million in 1991 to over $600 million in 1997, now constituting about 2.5% of university R&D expenditure (GAO, 1998).

Furthermore, from the same time span of 1980 to 2000, over 3,000 academic spinoff companies were created in the United States (Pressman, 2002). However, since there are a large number of universities located within the US, with a respective number of faculty, staff and students, this number in comparison to the number of spinoffs can be viewed as relatively low. Shane (2004) explains that establishing university spinoffs are rare but they are incredibly important. According to the Association of University Technology Managers (AUTM), from 1980 to 1999, university spinoffs within the US generated over $33 billion (Baycan and Stough, 2013). During the same time period, spinoffs produced more than 280,000 jobs, with an average of 83 jobs per spinoff. According to Cohen (2000), the regular university spinoff creates more jobs than the typical small business founded in the United States. In 2005 alone, more than 600 university-based start-up companies were launched; meanwhile over 5,000 new firms based on university-owned IP have been created since 1980 (Siegel et al., 2007).

In addition, the creation of TTOs was not the only affect Bayh–Dole had on the university technology transfer environment. Bayh-Dole also changed incentives for firms and universities in an attempt to foster more technology transfer with each other. The Bayh-Dole Act streamlined the technology transfer process by establishing a uniform patent policy and eliminating many constraints on licensing (Siegel et al., 2003). Furthermore, the Act allowed universities to own the patents that were paid for by federal research grants. The writers of the Bayh–Dole Act expressed that by adopting a federal technology transfer policy coupled with university ownership and management intellectual property would increase commercialization activities because universities would gain flexibility in negotiating licensing agreements. Therefore, companies would be more willing to work with universities (Bayh, 1996).

However, the Bayh-Dole Act has not been the only reason for the increased commercialization of academic research (Mowery et al. 2001; Kortum and Lerner 1999). Since universities are increasing the amount and complexity of scientific research has led to a higher demand for scientific studies from the marketplace. It has also amplified the competition from scientists and, therefore, increased commercialization activities that include patents, licensing and start-ups as criteria for ranking universities. Because of these changes and new standards that are introduced to the university environment, academic culture has changed (Kumar 2010). As a result of the Bayh-Dole Act and the factors mentioned above the 'third mission' has become prevalent in many American universities. For example, Massachusetts Institute of Technology (MIT) mission statement explains that "Our mission is to move innovations and discoveries from the lab to the marketplace for the benefit of the public and to amplify MIT's global impact. We cultivate an inclusive environment of scientific and entrepreneurial excellence, and bridge connections from MIT's research community to industry and start-ups, by strategically evaluating, protecting, and licensing technology (tlo.mit.edu, 2018)." The 'third mission' activities include patenting, licensing and company formation along with teaching and research (Baldini 2006). This transformation has been followed by many other countries looking to increase their commercialization activities.

2.4.2 How Bayh-Dole Influenced Europe (TTOs in Europe)

In the past thirty years, nearly all research universities in the United States and Europe have established TTOs to commercialize university IP. The pattern, started in the USA, has become part of an international phenomenon that has helped establish increases in licensing, patenting, and university-based spinoff companies which are now prevalent across Europe, Australia, Canada, along with many other countries and regions (Wright

et al., 2007). The Bayh-Dole Act has become a standard model for university commercialization. Technology transfer has been recognized as the 'third mission' of universities in various European countries as well (Charles and Howells 1992; van Geenhuizen 2010). Technology transfer started to become more recognized in Europe in the early 1980s (Howell and McKinlay 1999). The pattern first became popular in the UK in the early 1980s and then spread to the Netherlands along with other northern European countries (Wright et al. 2002). The trend then began to spread to other southern European countries like France and Italy (Muscio and Geuna 2008). Particularly in the 1990s, commercialization efforts increased in many European countries due to a decrease in public funding. However, some debate from regulators has arisen pertaining to the role that universities have in society, along with a Bayh-Dole type of Act being adopted by many countries (Siegel et al, 2007; Wright et al. 2007). Goldfarb and Henrekson (2003) suggest this is because the US technology transfer system is more effective at commercialization of knowledge when compared to other countries.

This new type of legislation adopted throughout Europe also influenced who owned the intellectual property rights (IPRs) of the inventions. In the UK, technology transfer offices within the universities have increasingly enforced their ownership rights to the IP generated by academic scientists, with any royalties generated from the IP being distributed between the relevant parties on an institutionally organized basis (Siegel et al, 2007). In Sweden drastic changes occurred in research policy, thus the university teachers' exemption was created and gave IPRs to researchers (Kitagawa and Wigren 2010; Goldfarb and Henrekson 2003). Furthermore, Kitagawa and Wigren (2010), along with Goldfarb and Henrekson (2003) argue that these actions increased commercialization creation throughout the university technology transfer field in Sweden. A similar type of legislation was adopted in Finland in order to create a Bayh–Dole-type procedure where academic scientists owned their IP (Siegel et al, 2007). Both Germany and Belgium adopted Bayh–Dole-type legislation in the late 1990s. However, in Italy, academic researchers received the right of ownership of their IP but in most cases the university devises a formal agreement with academics on an individual basis for the university to retain the IP rights. Most European countries have changed their regulations to make it more attractive for researchers and academics to take equity in spinoff companies or receive royalties. In France, for example, it was illegal before 1999 for an academic to obtain equity in a spinoff firm (Siegel et al, 2007).

2.5 United Kingdom Technology Transfer Environment

In many regions throughout the United Kingdom, universities are regarded as fundamental resources for knowledge creation and are located at the epicentre of the knowledge-based economy, often acting as key foundations of innovation systems, supporting science and regional growth (Huggins et al., 2008). For example, Heriot-Watt University's Technology Transfer Handbook (2015) states in line with the University KE (Knowledge Exchange) strategy and the Outcome Agreement with the Scottish Funding Council, the TTO mission is to enhance the University's reputation, financial stability and societal impact by progressing and exploiting any and all intellectual assets developed within research activity. Additionally, UK policy pertaining to the technology transfer environment over the last several years has encouraged many universities to develop the 'third mission' strategy similar to their American counterparts as these commercialization activities performed on behalf of the universities help foster regional economic development (NCIHE, 1997; Charles, 2003). Policy interventions created by the UK government have highlighted the government's position to develop a stronger commitment to science and technology in both national and regional governments. Furthermore, the government has expressed the importance of the UK university sector by passing legislation that will facilitate the growth of the knowledge-based economy. In addition, the past several years has observed commercialization of university-generated knowledge/technology taking a more robust role within government policies (Lambert, 2003; Sainsbury, 2007).

A study that has been conducted by Huggins and Kitagawa (2012), examines what they call knowledge transfer and commercialization (KTC) activities throughout the United Kingdom and breaks the quantitative study into regions. The summary of the analysis is generated around financial data as well as the income received by the universities on behalf of their technology transfer activities. Table 1 shows how much income has been generated by the universities based on regions throughout the UK in 2005/2006 (Huggins and Kitagawa, 2012: 821)

Region	**Total higher education value added (£, thousands)**	**Contribution to regional gross valued added (%)**
Eastern England	913,116	0.83
London	2,558,439	1.30
Northern Ireland	269,142	1.02
West Midlands	899,526	1.01
South East	1,595,976	0.90
Scotland	969,619	1.07
North East	511,966	1.32
Wales	578,773	1.36
East Midlands	736,900	0.99
North West	1,174,995	1.06
South West	712,005	0.80
Yorkshire and the Humber	1,004,509	1.22
United Kingdom	11,924,965	1.03

Table 1: UK Regional Income

Source: Adopted from Huggins and Kitagawa (2012: 821)

Furthermore, Huggins and Kitagawa (2012) analysed another set of data sourced from the Higher Education and Business Community Interaction Survey (HEBCIS) which is also available at the Higher Education Funding Council for England (HEFCE; which also covers Scotland, Wales and Northern Ireland). The data shows all universities within the UK and consists of a number of metrics relating to technology transfer or KTC activities. Their analysis, presented in Table 2, shows the percentage of income generated from KTC across the UK university sector consisting of collaborative research (28.3%), contract research (33.2%) consultancy contracts (12.2%), facilities and equipment related services (3.9%), courses for business and community (20.6%) and intellectual property income (1.7%) (Huggins and Kitagawa, 2012: 822).

Region	Percentage change in income, 2001/2002 – 2006/2007	Percentage of income generated from within each region
Wales	120.4	8.4
North East	81.9	21.9
Eastern England	68.0	23.3
London	141.6	23.6
Scotland	107.6	22.6
South East	116.4	23.0
North West	179.4	35.1
West Midlands	162.4	25.5
East Midlands	63.4	18.2
South West	170.3	29.8
Yorkshire and the Humber	144.6	59.9
Northern Ireland	23.5	
United Kingdom	118.5	

Table 2: UK Percentage of Income

Source: Adopted from Huggins and Kitagawa (2012: 822)

Additionally, a study conducted by D'Este and Patel (2007), explores the key interactions between how academics and industry partners within the UK interact with each other. Their data comprised surveying 4,337 academics throughout the UK who conduct research in: chemical engineering, chemistry, civil engineering, computer science, electrical and electronic engineering, general engineering mathematics, mechanic (aeronautical and manufacturing) engineering, metallurgy and materials and physics. They show that there are five key categories in which the interactions occur. They explain the first way academics and industry interact is through industry sponsored meetings and conferences. These meetings are grouped together and are usually informal, meaning there is no contract signed at these conferences. The second way is through consultancy and contract research between industry and academic researchers. This involves formal contracts and the definition of a specific set of expectations from both parties at the start of the contract. The third category includes creation of spinout companies and facilities that often include industry funding. This category means that both the university and the industry partner will be heavily involved in the creation of the new firm. The fourth group focuses on training relationships. This is accomplished by

either joint training by university and industry of PhD students or training for company employees enrolled in courses taught by the university. The fifth group pertains to joint research between the industry partner and university. D'Este and Patel (2007) also show that in four out of the five interaction types, over 40% of UK university researchers had been involved in working collaboratively with industry. Furthermore, their study concludes that university researchers' exchanges with industry partners are evenly spread across UK regions.

Even though the United Kingdom as a country is one of the best in generating knowledge and technology it is lacking in the ability to commercialize intellectual property. For example, a recent report published by Heriot-Watt University and the Manufacturing Technology Centre (MTC) called "Measuring Technology Readiness for Investment" (2017), shows that the UK is ranked number 1 in the world in terms of innovation performance. This means the country's ability to produce new ideas, create knowledge and generate IP. However, this same report showed that the UK was ranked in the mid-thirties when compared to the rest of the world in the country's ability to commercialize their intellectual property. The data and statistics for this report conducted by Heriot-Watt University and MTC were provided by the Global Innovation Index (2016: 296-390).

Furthermore, the Dowling Review, which is a UK government funded report, suggests that the basis for technology and knowledge transfer in the United Kingdom was based on trust and mutual understanding. The report also adds the ability to comprehend all of the different goals from the groups involved in the commercialization process. Specifically, the Dowling Review of Business-University Research Collaborations in July 2015 (p. 65) concluded,

> People are at the heart of collaboration. Personal relationships, based on trust and mutual understanding, form the foundation of successful partnerships between business and university. Policy interventions in and of themselves do not create trust. It is developed when people work across institution boundaries and understand each other's motivations and are able to see common goals.

The key phrases that are highlighted in this quote from the Dowling Review include mutual understanding, personal relationships and understanding each other's motivations. This thesis argues that the best way to develop relationships and create mutual understanding throughout the university commercialization process is by making sense of discourse used by different groups of people.

Spinout Companies

One of the increasingly popular ways for academics and industry to interact is the development of spinout companies. Wright et al. (2004: 235), express that "the creation and sharing of intellectual property is the core role of a university – the prime asset". As mentioned previously, there have been several policy debates throughout the UK government concerning how to manage university IP in order to generate wealth for both the university and the surrounding economies (HM Treasury and DTI, 1998). To further promote the creation of spinouts, the UK government established the £50 million "University Challenge", a venture capital fund created by 12 government sponsored science enterprise centres. In addition, the Lambert Report, which assesses collaboration between universities and businesses, concluded that a large amount of money can be generated from the transfer of technologies from universities to businesses (Lambert, 2003).

Wright et al. (2004), explain that culture within the university system is changing throughout the UK. They believe that there is a greater acceptance towards entrepreneurship across science departments within universities. Furthermore, universities' strategies towards commercialization of IP have generally focused on licensing as their main form of income (Siegel et al., 2003). However, Wright et al. (2004) believe that because of the changing attitudes within the departments, universities are now focusing more on generating spinout companies. For example, the number of spinout companies created in the UK in 2001 represented 31% of all spinouts formed during a period between 1996 and 2001 (Wright et al., 2002).

2.6 Technology Transfer Environment in Scotland

Scotland has had a long-established regional development agency called Scottish Enterprise, which was created in 1991. The idea was to create support mechanisms combined with the best research/researchers in the world (Lyall, 2007). In 2005, university disbursement into research and development projects was £688 million and in terms of the percentage of gross domestic product ranked the highest of all UK regions (Scottish Government, 2008a). In addition, Scotland was the first region in the UK to develop a regional science policy. The regional science policy legislation in Scotland, coupled with the funding council, helps to promote new strategies for universities which include knowledge exchange activities and a strategic approach to research funding and resources in an attempt to compete in a global knowledge-based economy (Huggins and Kitagawa, 2012). Furthermore, a report titled "A Smart, Successful Scotland" (Scottish Executive, 2001a) identifies three key themes that were deemed important by the

government: growing businesses; ensuring global connections; and enhancing the learning and skillset of Scots. Another report titled a "Global Connections Strategy" (Scottish Executive, 2001b) explains Scotland's strategic direction for commercializing on the opportunities surrounding the knowledge-based economy and putting in place the necessary mechanisms to ensure Scotland is a globally integrated economy.

In January 2001, the Minister of Science published a reported called "A Science Strategy for Scotland (Scottish Executive, 2001c) which expresses the need to maintain a strong science base and calls for an increase in the effective utilization of scientific research created in Scotland. This resulted in enlarged funds for Scottish university science departments as well as bigger subsidies for knowledge exploitation initiatives such as the Proof of Concept awards and the Royal Society of Edinburgh and Enterprise Fellowships (Lyall, 2005). In addition, the Scottish Government sees university education as one of the seven key sectors of the Scottish economy, thus there has been an increasing commitment to knowledge and technology exchange from the academic sector which has been promoted by the Scottish Funding Council (SFC). Furthermore, the Scottish Government has stated that knowledge and technology exchange can improve Scotland's social and economic well-being (SFC, 2007).

Scotland has 20 universities and higher education institutions (HEIs) funded by the SFC. Scottish universities generate a large income from technology transfer activities. Between 2005 and 2007, the total income generated from technology transfer was £583 million, which consisted of a variety of categories. These categories consisted of external research grants, contracts and consultancy (64%), licensing (4%), venturing (8%), enterprise (2%), continuing professional development (18%) and outreach (4%) (Scottish Government, 2008b). These percentages are based on the overall income generated from the 2005 to 2007 period. Moreover, a Higher Education Business and Community Interaction survey of 2014-15 shows that universities in Scotland have had a financial increase to £4,175,598 (£000s cash terms) within that time period (HEFCE, 2016). Furthermore, the SFC has invested more than £1.7 billion to universities and colleges during 2009-2010 (SFC, 2009). Table 3, sourced from Huggins and Kitagawa (2012: 823), shows the total KTC income and percentage of all Scotland pertaining to each individual university.

University	KTC Income (£, thousands)	Percentage of all Scotland total
University of Edinburgh	41,619	17.9
University of Glasgow	39,326	16.9
University of Strathclyde	38,729	16.7
University of Aberdeen	32,308	13.9
Heriot-Watt University	22,959	9.9
University of Dundee	19,819	8.5
University of St. Andrews	9,121	3.9
Glasgow Caledonian University	8,308	3.6
Robert Gordon University	7,140	3.1
University of Stirling	5,813	2.5
University of Paisley (University of the West of Scotland)	3,117	1.3
Queen Margaret University	2,210	1.0
University of Abertay Dundee	1,130	0.5
Glasgow School of Art	552	0.2
Royal Scottish Academy of Music and Drama	70	0.0
Scotland	232,221	100.0

Table 3: Scottish University KTC Income

Source: Adopted from Huggins and Kitagawa (2012: 823)

2.7 Key Differences between the US and UK Technology Transfer Environment

There are several key differences between the technology transfer environment in the United States and the United Kingdom. The differences should be noted because there is a general sense that the UK is not as advanced as the US in the university technology transfer industry (Siegel et al., 2008). In the US, the Bayh–Dole Act requires that scientists must divulge inventions that were generated from federally funded research to their university TTO. There is no such legislation in the UK. However, the 1997 UK Patent Act stipulates that, so long as it is stated in the employment contract, all inventions of academics who are contracted to create inventions are owned by the university. If

ownership is not stated in the academic's employment contract then the (IPR) belongs to the creator (Siegel et al, 2008). Thursby and Kemp (2002) argue that because of this legislation typically less than half of all research inventions with commercial potential are disclosed to university TTOs. They further explain that since it is not compulsory for UK academics to release scientific discoveries the exact number of a university's available technologies for potential commercialization is unknown. Furthermore, the use of patents as a potential indicator of university technology commercialization is also challenging because there is a considerable difference in quality and patenting strategies across universities. Some universities produce many patents because start-up costs are relatively minor. However, universities have found that the cost of enforcing patents is momentous and sometimes not worth the struggle and effort. Regardless of the limitations of invention disclosures and patents as indicators, the UK still uses them as a measure of technological input.

Another legislative approach undertaken by the UK which differs itself from the US is the Easy Access Intellectual Property Scheme. This licensing approach was developed by the Glasgow University, Kings College London and Bristol University as an attempt for universities to build relationships with industry partners (Gov.uk, 2015). The Easy Access IP offers certain technologies at no cost and helps to provide businesses with a simple licensing agreement. There are no royalties to pay to the developer of the technology, but businesses are required to pay for ongoing patent costs. By opening the technology to businesses and private companies this helps to creates an opportunity to commercialize university IP at a reduced risk and further develop the technology which otherwise would probably not happen (Gov.uk, 2015).

Other differences between the US and the UK in the technology transfer field go beyond legislative points of view but also focus on some cultural differences. The two countries score similarly to Hofstede's culture dimensions (Czinkota et al., 2002) and the UK has a lower rating for `Uncertainty Avoidance` which could lead one to suspect a great risk-taking attitude (Hofstede, 1997). However, in university to industry technology transfer, availability of venture capital and different outlooks towards entrepreneurial role models, the UK and US are vastly different (Tidd et al., 2001). In addition, Lockett et al., (2002) states there has been an upsurge in technology and knowledge investments from UK venture capitalists since 1991.

A study conducted by Decter et al. (2007), was comprised of semi-structured interviews from academics in the US and the UK consisting of 32 participants from the UK and 57 from the US. The survey results show some drastic differences between the

two countries. Decter et al. (2007: 154) make some suggestions for improvements in the UK technology transfer environment:

i. The tendency to ‘‘publish not patent’’ may be a hindrance to the availability of protected technologies in the UK which should be recognised. Promoting a better understanding of ‘‘disclosure’’ issues and the implication of the possibilities arising from commercialising research could help to address this. (i.e., Patenting need not mean not publishing—it is all about timing).

ii. UK industry is perceived to be less interested in, and more sceptical of, university technology. Two possible approaches to overcome this problem are to attempt to market UK university technologies more effectively and to consider marketing UK university technologies abroad.

iii. The use of university technology could be marketed as an ‘‘outsourcing route’’ for some company R&D activities in the UK to replace lost R&D activities. However, the absorptive capacity required for this to work efficiently may have also been lost with those R&D activities.

iv. UK university technology transfer policies are more diverse than in the USA and technology is more difficult to access. There is therefore a greater need for knowledge of university systems and ability to access university technologies within UK companies. Government funding of the university–industry interface to provide more transparent systems and encourage communication would be helpful.

v. Given the lack of resources and experienced staff in some UK university technology transfer offices, current university activities in technology transfer should be enhanced.

2.8 Introduction to Discourse

In this section of the literature review, the concept of discourse will be discussed as it is a vital aspect of how technology transfer offices make sense of discourses used by academics and practitioners and help to facilitate communication between these groups. This section will address what discourse is and why it is important to TTO employees. In addition, organizational discourse will be discussed for a variety of different reasons. TTOs, academics and businesses all represent different organizations and therefore have different ways of communicating within those organizations. Thus, they use different discourses in order to describe a particular set of circumstances, events and actions. Furthermore, organization discourse is discussed because the concept illustrates different domains in which group members communicate discourse within their organization. It is

argued by this thesis that these domains (narratives, stories, conversations, dialogues, metaphors and tropes) can be used by TTO staff members in order to make sense of discourse used by academics and industry partners.

Technology transfer offices are specific organisations located within the walls of the university, but their actions and goals are similar to that of businesses rather than research academic as they help generate an income for the university by commercializing the intellectual property, by generating patents, creating licenses or the development of spinout companies. However, TTOs and their employees are located in an unusual position within the university. Rarely are they employed as academic members of staff though they do occasionally have specialist technical knowledge. They are however not employed directly in industry with their status as university employees positioning them at an interesting intersection of the academia – industry relationship. Since the goals of businesses and academics are often different, the TTOs act as mediators between these groups though they may not be considered experts by either and indeed they may be misconstrued as "belonging" to industry (by academics) and to the public sector (by industrial partners). The TTO's ability to making sense of different discourses and to construct mutual understanding between these groups is vital. Currently, there is very little academic literature addressing how TTO employees communicate between different organizations, make sense of different discourses and how they facilitate that information to others. This is why understanding discourse, especially discourse that is used by different organizations and how to make sense of it, is the basis for this study.

For the purpose of this thesis, the concept of discourse is defined as all forms of communication that could occur (from describing the technology to managing time scales) including multiple devices (telephone, email, etc.) between TTOs, academics and industry. Some scholars will argue that the concept of discourse should not be used generally, and it is a specific term. However, other academics have argued that the term discourse is a general term which can be applied to many different fields. Illustrating the word discourse as a general phrase with a multitude of meanings rather than a specific term will help provide a theoretical basis for the context of technology transfer. Therefore, this study illustrates the complexity of how TTO employees make sense of a generalized term such as discourse, which has not been widely addressed by scholars in this context.

2.9 What is discourse?

The word discourse is used in many ways depending on the academic areas that study discourse and it can be applied to a variety of different fields. The general explanation provided by Mills best describes the term discourse for this thesis. Mills

(1997) argues the term discourse has become a collective term for a variety of disciplines, such as critical theory, sociology linguistics, philosophy, social psychology and many other areas. The term discourse is used with such frequency it is often left undefined, as if the meaning of the word were common knowledge. Therefore, discourse can be analysed in the same way as any other academic field because of the interpretation of the meaning and how it correlates to a specific context. Furthermore, Bargiela-Chiappini (2009: 232) argues that because definitions of discourse can be so broad, ultimately, discourses "are elements of culture." Additionally, since discourse is part of culture "discourses, then, are sets of concepts, statements, terms and expressions which constitute a way of talking or writing about a particular aspect of life, thus framing the way people understand and act with respect to that area of existence (Bargiela-Chiappini, 2009: 231).

Linguistic scholars like Gee argue that discourse is a portion of language that has an intimate relationship with syntax. Syntax is the structure of the language, specifically referring to the way words and phrases are combined in order to make sentences (Gee, 2014). For example, Gee (2014) explains that language used in a movie flows in a sequence throughout a particular period of time otherwise known as a frame. In language, linguistics scholars refer to this idea of "frame" or a particular period of time as a sentence. Furthermore, syntax names the rules (conventions) that are followed when parts of a sentence are composed. This is one way in which linguists have given meaning to the word discourse. Gee (2014: 18) explains that "discourse is the sequence of sentences. It is the ways in which sentences connect and relate to each other across time in speech or writing."

However, Foucault (1972: 80) argues that discourse is more than simply syntax; it is something that is constantly changing:

> Instead of gradually reducing the rather fluctuating meaning of the word discourse, I believe I have in fact added to its meaning: treating it sometimes as the general domain of all statements, sometimes as an individual group of statements, and sometimes as a regulated practice that accounts for a number of statements.

Furthermore, Fowler (quoted in Hawthorn, 1992: 48) explains:

> Discourse is speech or writing seen from the point of view of the beliefs, values and categories which it embodies; these beliefs, etc., constitute a way of looking at the world, an organization or representation of experience – ideology in the neutral non-pejorative sense. Different modes of discourse encode different representations of experience; and the source

of these representations is communicative context within which the discourse is embedded.

Hanks (1996) says that discourse is language in action and in order to study discourse it requires attention to both language and to action. Furthermore there is a long tradition of studying discourse in linguistic terms, either as a complex of linguistic forms which are larger than a single sentence or as language in use, i.e., linguistic structures actually used by people, otherwise known as real language (Brown and Yule, 1983; de Beaugrande and Dressler, 1981). In addition, Jan Blommaert (2005) argues that discourse pertaining to interactions with people can also be non-linguistic. This means discourse can encompass all forms of action seen in connection with social, cultural and historical patterns and developments.

For the purpose of this thesis the term discourse is used to represent the dynamic nature in which employees of technology transfer offices communicate between academics and industry partners. TTO employees are immersed in the discourse of commercialisation due to the dynamic role of the TTO and their employees. Discourse is constantly changing from the use of acronyms, technology, job roles within the organization, changes of jobs from academics or businesses, the closing and opening of businesses/organizations, and many other reasons. No two situations are ever going to be the same. So, in order for the TTO to be successful they have to change their use and understanding of the discourse depending on the role they will play in order to communicate between multiple groups of people. This is why organizational discourse and understanding the different domains is used as the theoretical background concerning the sense-making strategies used by TTOs in order to help improve the discourse between individuals representing different organizations during commercialization process.

2.10 Organizational Discourse

The field of organizational discourse has borrowed widely from other academic fields and therefore displays similar characteristics when compared to those other areas of study. The expansion in interest of organizational discourse has led to the application of discourse analytic approaches to variety of ways in which individuals communicate within an organization. Grant et. al (2004) argues that organizational discourse allows for investigation, participation with and provides an understanding for a multitude of organizational-related issues in ways that would not otherwise have been known. Furthermore, Grant and Marshak (2006) define organizational discourse in a general sense that includes speech, writing, visual representation, and cultural artefacts that bring

ideas into being and mediate experiences within organizations. In addition, Grant and Hardy (2004: 6) state:

> The structured collections of texts embodied in the practices of talking and writing (as well as a wide variety of visual representations and cultural artefacts) that bring organizationally related objects into being as these texts are produced, disseminated, and consumed.

The term organizational discourse refers to the structured gatherings of texts. Specifically, Hardy and Phillips (2009: 300) argue that discourse in an organizational context is defined as "structured collections of texts, and associated patterns of textual production, transmission, and consumption, located in a historical and social context". Text in this sense comprises the discursive unit of analysis (Marshak and Grant, 2008) and refers not only to printed texts, but also to other forms of symbolic representation that can be stored in both the physical or digital medium (databases and other computer files, rich media, recordings, and transcriptions) (Hardy and Phillips, 2009). Therefore, text used in organizational settings while group members are communicating with one another (such as talking and writing, as well as a visual representations) that bring organizationally related objects into being as these texts are created, distributed and consumed (Phillips and Hardy, 2002; Grant et. al., 1998; Parker, 1992). Consequently, texts created by the organization can be considered to be a creation of the discourse and the discursive unit (Chalaby, 1996). This is why organizational discourse researchers tend to focus their attention on this particular area. The text observed by the researcher signifies a collection of interactions, media of discourse (i.e., oral, print, electronic), or an accumulation of oral and written forms (Putnam and Cooren, 2004). This definition demonstrates that researchers studying organizational discourse are often interested in the social constructionist (Searle, 1995; Berger and Luckmann, 1967) effects of language and dialogue used in organizational settings (Phillips and Hardy, 2002). Furthermore, as Mumby and Clair (1997: 181) suggest a radical structuralist paradigm (chapter 4, section 4.1):

> Organizations exist only in so far as their members create them through discourse. This is not to claim that organizations are 'nothing but' discourse, but rather that discourse is the principle means by which organization members create a coherent social reality that frames their sense of who they are.

By studying how discourse shapes the organizational processes, academics can research the interaction and communication of different groups within the technology transfer environment.

For the purpose of this thesis, the definition of text is best described by Marshak and Grant (2008) and Hardy and Philips (2009) in the previous paragraph. Additionally, there are four domains that are prevalent in organizational discourse studies: conversation and dialogue, narratives and stories, rhetoric, and tropes. These domains are not exclusive; however, they have been chosen for two reasons. Firstly, they are widely studied in the field and therefore help shape the understanding of organizational discourse. Secondly, the four domains help explain the variety of different ways discourse can be communicated by either the TTO employee, academic or industry partner throughout the commercialization process. Furthermore, the domains illustrated over the next several pages are included in the greater context of discourse throughout this thesis.

2.10.1 Conversation and dialogue

Both conversation and dialogue are defined as a set of interactions that are produced as part of either the talk or message exchange process between two or more people (Putnam and Fairhurst, 2001; Taylor and Van Every, 1993). For the purpose of this thesis, conversation and dialogue are considered to be two different concepts. Conversations occur over a period of time and are connected through time. This means that the texts created only exist as part of the same conversation if they are formulated as a response to each other, either directly or indirectly and are produced through discursive acts (Ford and Ford, 1995; Westley, 1990; Collins, 1981).

Dialogue is a part of a conversation that is created through the organization and is not the result of random utterances or isolated texts between people but, rather, is produced through ongoing exchanges among organizational members that become the basis for further conversations (Taylor et. al., 1996; Fairclough, 1992). Eisenberg and Goodall (1993) and Putnam and Fairhurst (2001) argue that dialogue in organizations tends to focus on the style of discourse that is generated between groups of people through awareness of others involved in the dialogue. In contrast to conversation, dialogue has a strong chronological and linguistic orientation; therefore, dialogue has been described by Cissna and Anderson (1998), as a momentary accomplishment. Furthermore, Bakhtin (1981), Buber (1958), Bohm (1996), and Eisenberg and Goodall (1993), explain that researchers of dialogue and discourse have sought to show how it is used to generate new meaning and understanding amongst organizational members. In addition, dialogue can create space in which to question, examine and be used as a way to mediate between

group members which can lead to a discussion of personal views (Gergen et. al., 2001; Gergen, 1999; 1994).

However, because of the many different dialogues and the meanings of dialogues discourse can sometimes become lost in translation (Graham et al. 2006, Shapiro et al. 2007, Fincham and Clark 2009). Furthermore, if the interpretation of the dialogue is incorrect this can lead to an awkward or stressful situation. This is why many higher education business school academics study the creation of knowledge management (Fincham and Clark, 2009; Spell, 2001; Barley et al., 1988) and their ability or inability to develop/conduct research with practitioners and then effectively communicate the results to those industry partners. Shapiro et al. (2007: 249) explain that this is an expansive debate which can be framed as either a 'knowledge transfer problem' ('lost in translation') or a 'knowledge production problem' ('lost before translation').

Kieser and Leiner (2009: 517) argue that confusion in discourse "is not only attributable to different dialogues and styles in the scientific community, but also to different logics" meaning there are differences in defining and tackling problems "that prevail in the systems of science and practice". For them the terms of "science" and "practice" are based on completely separate thought processes and one of the consequences of that discourse is that knowledge transferred from one individual to another can never be fully absorbed (Fincham and Clark, 2009). Assuming these separate groups are unable to communicate with one another, both Kieser and Leiner attempt to bridge the language gap between multiple members.

Contrary to Kieser and Leiner's assertion that it is not possible to fully translate scholarly articles into understandable texts for practitioners, Hodgkinson and Rousseau (2009: 541) state:

> A growing number of publications authored by leading researchers, some written in collaboration with practitioners, are seeking to meet this important gap in the marketplace, propelling the movement towards management practice informed by robust theory and research.

Additionally, they argue that management studies are a broad academic field and dialogue gaps between research and practice are to be expected and, in some cases, expansive. However, there are numerous examples of successful partnerships between academics and practitioners that have led to the development of high-quality research (examples of such research can be seen in Ariely, 2008 along with Thaler and Sustein, 2008). They further argue that:

> developing deep partnerships between academics and practitioners, supported by appropriate training in theory and research methods, can yield outcomes that meet the twin imperatives of high quality scholarship and social usefulness, to the mutual benefit of both agendas, without compromising the needs of either party in the relationship (Hodgkinson and Rousseau, 2009: 538).

For them bridging the dialogue gap should be the primary objective of business management scholars because working together simultaneously can create a more detailed understanding of how organizations work and become successful.

Furthermore, practitioners spend a lot of their time developing specific dialogues, meaning they spend the majority of their time providing accounts to other people, justifying why certain practices are done, defending their own actions and trying to convince other people why certain actions need to take place (Boden, 1994; Gowler and Legge, 1983; Davis and Luthans, 1980). Although the dialogues employed by practitioners have been studied at length (Chen et. al., 2013; Kelemen, 2000; Czarniawska-Joerges, 1993; Mintzberg, 1973,), a relatively small amount of consideration has been developed on how languages are communicated in management research (MacIntosh et. al., 2017; MacIntosh et. al., 2012; Mauws and Phillips, 1995; Astley and Zammuto, 1992). Specifically, Carlile (2002: 444) states that "even if a common syntax or language is present, interpretations are often different." While the substance of research has a substantial role in gaining the attention of the practitioner to a particular piece of work, the way it is communicated on behalf of the academic (i.e., the discourse used by the researcher) often does not capture the imagination or retain the interest of the practitioner. That is why academic research rarely has a significant impact towards practitioners. Kelemen and and Bansal (2002: 99) state that "it is not very often that academic research is translated into a language that practitioners would find appealing". Consequently, there is often a discourse gap between practitioners and academics because the information is not communicated clearly between two groups of people.

2.10.2 Narratives and stories

Another important aspect located within the field of organizational discourse is that of narratives and stories. Sometimes narratives and stories are used to explain a particular set of events from different perspectives. Additionally, narratives and stories can be used to help others gain understanding of a set events that has happened in the past. For example, Bargiela-Chiappini (2009: 232) argues that "if discourses are elements

of culture then narratives and stories can be seen as elements of discourses." Bargiela-Chiappini further suggests that the term narrative is a general description and can be defined in a generic way. For example, (Bargiela-Chiappini (2009: 232) states that a narrative "is an account of a particular aspect of the world which follows a basic form of 'this (the first event happened), then that (the next event happened, then that (followed by the next event that happened).'" Therefore, a complex story is often comprised of simple narratives. Additionally, several narratives are often part of the greater story.

The study of narratives examines the context in which the narrative is being used and constructed. It can be used as a form of analysis, which analyses how narratives and stories become symbols created by the people in the stories. Organizational researchers have used narrative analysis in order to demonstrate how narratives and stories are produced by either verbal (oral or spoken) and/or written exchanges from group members. According to Grant et al. (2004), narrative analysis is widely used in organizational studies and it has become a popular approach to study both discourse and communication. The purpose in conducting a narrative analysis is to focus on the topics, ideas, characters and plots within a particular text or texts created by members of a specific group. Narratives are also thematic in nature in that they tell a story; sometimes true, sometimes fictional. They are co-constructed by the individuals involved. Moreover, these individuals may also use specific ideologies to epitomise the interests of a specific group (Boje, 2001; Czarniawska-Joerges, 1998). Brown (2004); Dunford and Jones (2000); Wallemacq and Sims (1998); and Weick (1995) have expressed how narratives are an essential part of the sense-making process in organizations. Understanding narratives is a critical element in analysing the way in which we think about ourselves and how we relate with one another (Ochs, 1997).

By examining different texts such as conversations, dialogue, authorised documents, newspapers and websites, a narrative analysis can offer an understanding into how meaning is socially constructed, and action is created within organizations or specific groups of people (Brown, 1990). For example, Hansen and Kahnweiler, 1993 have studied the components of organizational culture, as shared identity among individuals involved within organizations (Brown, 1990; Meyer, 1993) and as expressions of political authority and opposition (Gabriel, 1995). Narratives have also been used to study organizational policy, strategy and change (Washbourne and Dicke, 2001; Beech, 2000).

2.10.3 Rhetoric

Narrative and stories are only part of the domains pertaining to discourse. The domain rhetoric is the study that allows for the consideration of how discourse can be

used in order to achieve particular ends (persuasion). Aristotle described rhetoric as ways that humans can be compelled to believe something (e.g., through torture or physical coercion). Aristotle believed that individuals persuade others through three concepts. The first is ethos or the character or credibility of the source of communication. The second concept is called pathos or the stirring of emotion in the individual(s) being persuaded. And, lastly, logos which is the proof of truth (or apparent truth) through reasonable argument (Bargiela-Chiappini, 2009: 71). These three concepts of persuasion came to be known as the rhetorical appeals and are often a fundamental source for academic work of a rhetorical scholar working from a traditional perspective.

Academics that focus on rhetoric base their findings on various elements of argumentation to determine how and what exact aspects of discourse are used in organizational practices. For example, symbolic and rhetorical devices can be used to communicate a corporate or governmental image and strategy. These same devices can also be used to shift blame and provide some distance from the organization and away from a potential problem (Mortensen, 2012; Campbell et al., 1998; Keenoy and Anthony, 1992). Furthermore, rhetorical devices used during argumentation can examine particularly how it relates to the decision-making, bargaining and negotiation processes (Gulber et. al., 2015; Putnam, 2004; Putnam and Jones, 1982).

2.10.4 Tropes

Heidt (2013) along with Putnam and Fairhurst (2001) have suggested, the concept of rhetoric is filled with several different types of literary devices. The most significant of these devices include: tropes of metaphor, synecdoche, metonymy and irony (Morgan, 1983; Manning, 1979; White, 1978). The trope of metaphor is a concept in which two separate intangible ideas are compared, with the more abstract notion becoming better understood (Morgan, 1980). Synecdoche and metonymy are often confused. Both concepts involve the mapping or connection between two things within the same area of thought (e.g., a part-whole or a whole- part substitution) or between closely connected ideas (e.g., a cause and effect relationship). Finally, irony involves the use of discourse as an alternate way to describe something that is absurd or contradictory. This happens when an unexpected outcome or surprising change of events develops from the way a particular set of circumstances evolves which is opposite to what was intended (Westenholz, 1993).

Specifically, the study of the metaphor has contributed to organizational studies in several ways. Metaphors can enable new knowledge construction and provide inventive new perspectives towards organizational theory and behaviour. Furthermore,

metaphors have been used by academics to both theory-build and provide methodological tools (Cornelissen and Kafouros, 2008; Putnam et al., 1996; Alvesson, 1993). There have also been numerous studies that have examined how metaphors can influence organizational discourses and how they relate to organizational phenomena (Suchan, 2014; Broussine and Vince, 1996; Warner-Burke, 1992).

2.10.5 Conclusion to Research Context

These two sections of literature review have illustrated the context on which this research project is based. The context portions of the literature review chapter specifically highlight what a technology transfer office does, the rationale for a university to have a TTO, and how the widespread success of commercialization in the United States influences Europe. Furthermore, the section explains the technology transfer environment in the United Kingdom along with industry in Scotland. Lastly, key differences between the UK and US were examined in order to show how the industry differs, along with potential problem areas within the UK.

One of the key paragraphs in this chapter is located in section 2.5 and is from the 2015 Dowling Review. This section illustrates the need for mutual understanding, developing relationships between different industries, along with understanding of other group members' motivations and goals. Furthermore, this thesis argues the best way for a technology transfer office to do this is by making sense of academic and industry discourses, which is discussed in chapter 2 section 2.11.2 the discourse between these two groups is often described as being problematic. Additionally, these criteria are highlighted by participants of this research study throughout the findings chapter.

By having established what TTOs do, it is now possible to focus attention on ways in which it is possible to theorize about their role. First, this thesis considers TTO staff members as enablers of discourse pertaining to knowledge dissemination and commercialization. This is done by TTOs making sense of this discourse and then distribution of that information to other group members in the commercialization process.

This thesis is not attempting to map the significant, complex and diverse nature of the literature pertaining to the concept of discourse. Nevertheless, the literature set out briefly above forms a backdrop to the theoretical context in which this thesis is conducted and is therefore a helpful starting point for a theoretically informed assessment of the operating environment in which TTOs and their employees work and commercialize university intellectual property. This is why understanding and using multiple discourses plays a vital role for the TTO. Discourse is used in every organization and is a part of everyday life. In the context of this thesis the concept of discourse is used as a general

concept that specifically pinpoints how it can be used in communicating between academics and industry partners. Discourse is developed through domains like dialogue, stories and tropes as a way of communicating or explaining a given situation or to describe, make sense of or comprehend a series of events. Once that is done through a period of time in a specific context it becomes discourse. Furthermore, it can encompass both verbal and non-verbal discourse, such as text (for example e-mails and memos). By understanding discourse, it can help to understand the main research question which is "what are the sense-making strategies used by TTO employees in order to communicate between academics and industry partners?"

2.11 Theoretical Positioning: Introduction to Sense-making Theory

Discourse and the theories relating to discourse help to provide some context to the theoretical landscape of this thesis. However, the contributions that are generated from this body of research do not contribute to discourse. Sense-making theory is the main framing of this thesis and therefore contributions that are produced from this research are to sense-making. Even though sense-making is not inclusive to TTOs and their employees it is something that they do on an everyday basis. In order to complete their jobs or daily tasks they need to make sense of the world around them. As mentioned previously, TTOs work in an environment that is constantly changing which includes the people they work with, academics, businesses, funding bodies, and that they have multiple projects going on at the same time. This also means they are working with multiple discourses created by all of these groups on a daily basis. How do TTOs deal with all of this information that is being communicated by different groups of people? The next section in the literature review will illustrate what sense-making theory is, how sense-making applies to discourse, how the process happens, sensebreaking and sensegiving, followed by sense-making in mediation.

2.11.1 What is Sense-making?

Karl Weick is considered as the father of sense-making. He suggests that the term simply means "the making of sense" (Weick, 1995: 4). This deceptively simple observation suggests that we as individuals are compelled to engage in a process of "structuring the unknown" (Waterman, 1990: 41) by "placing stimuli into some kind of framework" that enables us "to comprehend, understand, explain, attribute, extrapolate, and predict" (Starbuck and Milliken, 1988: 51). Sense-making enables people to examine the complexity of the world into a "situation that is comprehended explicitly in words and that serves as a springboard into action" (Weick, et. al., 2005: 409). Thus, sense-making

acts as an expression of the unknown by attempting to explain the unknown so it can be truly understood (Ancona quoted in Snook et. al., 2012).

Sense-making is the belief that "reality is an on-going accomplishment that emerges from efforts to create order and make retrospective sense of what occurs" (Weick, 1993: 635). Individuals (otherwise known as actors) involved in sense-making, work through a process of social construction, they then interpret and explain the information that they received to produce credible reconstruction of their world view based on their perception. Therefore, sense-making becomes the basis for understanding the individual accounts involved in the process and it is a never-ending process that these actors make in real time (Gioia and Thomas, 1996; Gioia and Chittipeddi, 1991). In addition, sense-making is needed when our understanding of the world and how it works becomes confusing (Ancona through Snook et. al., 2012). This occurs when the actor's environment is under constant change or duress, therefore presenting the actors with situations for which they were unprepared for and must become adaptive (Heifetz, et al., 2009).

People involved in the sense-making process (actors) develop their opinions on many different factors that include: their own unique individual contexts, including organizational positions, histories, and personal backgrounds, which position their sense-making towards the development of different representations (Weick, 1995; Gephart, 1993). Weick (1995: 18) has described several properties of sense-making, which he explained as "an observer's manual or a set of raw materials for disciplined imagination," of which three directly relate to actors' contexts. First, sense-making is imbued with identity construction, which means the identities of people involved in a specific context shapes how those individuals view the world (Pratt, 2000; Thurlow and Mills, 2009; Weick, et. al., 2005; Currie and Brown, 2003). Second, sense-making is retrospective, this means it is based on significate lived event (Schutz, 1962: 567), with actors relying on their experiences to make sense of their current situation (Labianca et al., 2000). Third, sense-making is a social process, which is simultaneously an individual and shared experience, representing "an evolving product of conversations with ourselves and with others" (Currie and Brown, 2003: 565).

Weick (2005, 1995) explains that sense-making is a process that is both ongoing and retrospective that is the development of plausible imaginations that help us to rationalize what people are doing. Gephart et al. (2010: 284-285) also agree that sense-making is ongoing. They state, "an ongoing process that creates an intersubjective sense of shared meanings through conversation and non-verbal behaviour in face-to-face

settings where people seek to/produce, negotiate and maintain a shared sense of meanings". It is viewed as an important process of organizing; sense-making can be described as an arrangement of circumstances during which the actors engage in continuous experiences from which they extract information and try and make sense of the scenario retrospectively. Taylor and Van Every (2000: 275) state "sense-making is a way-station on the road to consensually constructed, coordinated systems of action." At the way-stations, experiences are "turned into a situation that is comprehended explicitly in words and that serves as a springboard to action (Taylor and Van Every, 2000: 40)." There are three key factors pertaining to sense-making and organizational life. First, sense-making occurs when a movement of organizational events is spoken into words and placed into categories. Second, organizing the sense-making process is placed into either written or spoken texts, or both. Third, reading, writing, conversing, and editing are all crucial actions that serve as a way to shape the sense-making process (Gioia et al. 1994). In particular, this study offers an opportunity to examine the triggers for sense-making and the role(s) of those directly involved in commercializing university intellectual property and shaping the transition from a series of organizational events to an order and shared account of those experiences.

Sense-making as a process is one that is constantly ongoing, instrumental, subtle, swift, social and can easily be taken for granted by the actors in the sense-making process (Weick et al., 2005). Sense-making is crucial because it is the principal way in which meanings can emerge that ultimately enlighten and constrain identity and action (Milles, 2003). Furthermore, because meanings can emerge through social constructions, sense-making is an issue of understanding discourse which was illustrated earlier, in section 2.11.2. It is also an issue that deals with situations, organizations and environments which can be talked about or communicated into existence (Weick, 2005). Additionally, sense-making is about the relationship of action and the clarification of that action rather than the effect it has on evaluation pertaining to the choices that were made. When action is the prime focus, interpretation, not choice, is the significant phenomenon (Lant, 2002; Weick, 1993).

2.11.2 Sense-making and discourse

Weick has emphasized that research conducted into sense-making examines not the cognitive aspects of sense-making but, rather, the linguistic. For example, Weick (1995: 18) uses a rhetorical question in order to illustrate this point, "How can I know what I think until I see what I say?" Furthermore, Taylor and Van Every (2000: 40) state that "sense-making involves turning circumstances into a situation that is comprehended

explicitly in words". Bolander and Sandberg (2013) view sense-making and discourse from an ethnomethodology (a branch of sociology dealing with non-specialist's common sense understanding of the structure and organization of society) perspective and have studied how new employees (within an organization) have made decisions based on what was said by actors in actual meetings. They state that sense-making is produced by the creation of a "practical reality" (Bolander and Sandberg, 2013: 288) in which "action and context are mutually elaborative and mutually determinative elements in a simultaneous equation that the actors are continually solving and resolving to determine the nature of the events in which they are placed" (Heritage, 1987: 242). Karreman and Alvesson's (2001) research focuses on discourse generated by individuals who illustrate versions of their realities and identities in their performance of work-related environments. In addition, (Munir and Phillips, 2005: 1669) studies institutions and their ability to make sense and explains that it is a "textual affair" in which "discourses constitute institutions" and institutional entrepreneurship is accomplished and established through discourse. These scholars have spawned further studies which highlight the importance of discourse pertaining to interpretation and meaning production (Cornelissen et. al. 2008; Fenton and Langley, 2011).

One aspect of research focuses specifically on sense-making and how the theory pertains to narratives stories. Narratives and stories, defined earlier in section 2.10.2, are active constructions or reconstructions of actors' "realities" and "a potent tool for meaning-making" (Zilber, 2007: 1038). The process in which narration is used in stories is co-authored by multiple actors involved in the situation in order to account for past events that may be questioned or instances where actors might feel nostalgic. In addition, present context is most often unclear and confusing and future context has been described as desired and feared (Brown and Humphreys, 2002). Furthermore, Brown (2004) shows how one version of events can be perceived differently from other perspectives. Abolafia (2010: 350) analysed 14 years of Federal Open Market Committee (FOMC) transcripts, which allowed the study to focus specifically on the narrative process. This study showed how a policy group thinks throughout the interaction and negotiation process. Sense-making stories permit the actors involved in the study to manoeuvre between inconsistencies, to ignore doubts, to both disguise and divulge emotional responses and intellectual positions, while making sense of situations (Boudes and Laroche, 2009; Brown, et. al., 2012; Golant and Sillince, 2007; Pye, 1993).

Discourse plays a key role in speech act theory (Austin, 1962) as well as sense-making research (Weick, 2005). Furthermore, situations are constructed by their material

properties, which provide the necessary information of how individual actors shape the way they make sense of things (Akrich and Latour, 1992). In particular, this study examines how a third party who is not considered the expert in the field helps the sense-making process by noticing, bracketing, labelling and categorizing, which is discussed later in this chapter.

2.11.3 The Process of Sense-making

Weick et al., (2005) explain the processes of sense-making by examining how a nurse makes sense of potential problems with infant patients. This practice, developed by Weick and fellow authors, explains that sense-making starts with a flux or a problem. Specifically, Weick et al. (2005: 86) state that "sense-making starts with chaos." Furthermore, Chia (2000: 517) says the sense-making process starts with "an undifferentiated flux of fleeting sense-impressions and it is out of the brute aboriginal flux of lived experience that attention carves out and conception names." This means sense-making is based on previous experience specifically when problems arise through antecedents and coincidences. In addition, Näslund and Pemer argue that being in constant state of flux leads to storytelling in the sense-making process. Näslund and Pemer (2012: 106) state:

> If organizations are in a state of continuous flux, and their members use stories as a means of making sense of this flux, to label and categorize the events taking place, then the concepts used to label and categorize are a central part of the sense-making process. We argue that a dominant story may be able to fix the meaning of central concepts required to construct stories about the events in the organizations, so that they are given specific associative connotations in the local linguistic context of the organization.

2.11.4 Noticing and Bracketing

Weick et al. (2005) argue that the sense-making process starts with noticing and bracketing, and it is part of the initial stages of the practice. In the case of the nurse described by Weick et al. (2005), based on previous experiences which are guided by mental models which have been attained through work, training and life knowledge, the nurse would have a definition of normal and would be able to spot any potential problems that could arise. In this particular instance the process of sense-making (i.e., noticing and bracketing) means "inventing a new meaning (interpretation) for something already occurring during the organizing process, but does not have a name, has never been recognized as a separate autonomous process, object, or event (Magala, 1997: 324). Chia (2000: 517) explains that in the early stages of sense-making information "has to be

forcibly carved out of the undifferentiated flux of raw experience and conceptually fixed and labelled so that it can become common currency for communicational exchanges." This means that through experience, and as we make sense of things, eventually, the way in which information is communicated will be common knowledge for all people involved in the sense-making process.

Blasco (2015) explains that noticing and bracketing are a critical part of the experience in disruption. This involves identifying things that are abnormal when compared to the normal flux of events, which typically results in people looking for an explanation in their immediate context. Therefore, a new meaning, or category, must then be created for the experience that has occurred "but does not yet have a name" (Magala, in Weick et. al, 2005: 441), in order to allow the person to comprehend it and re-engage in the experience.

2.11.5 Labelling and Categorizing

Sense-making is also about labelling and categorizing as an attempt to stabilize the experience. Chia (2000: 517) explains that labelling workings through a tactic of "differentiation and simple-location, identification and classification, regularizing and routinization the intractable or obdurate into a form that is more amendable to functional deployment". Weick et al. (2005) explain the key words in Chia's statement are functional deployment. They argue that functional deployment means developing labels on events that are intertwined with one another in such a way that it makes the information more manageable and coordinated in order to distribute the material to others. Therefore, the ways in which situations are interpreted are immediately organized because the events are bracketed and labelled in ways for people involved in the process to gain a common knowledge of meaning. In order for people involved in sense-making to generate a common knowledge meaning, labelling ignores the differences among the actors and therefore deploys intellectual depictions that are able to generate habitual actions. For example, Tsoukas and Chia (2002: 573) state that, "for an activity to be said to be organized, it implies that types of behaviour in types of situations are systematically connected to types of actors…An organized activity provides actors with a given set of cognitive categories and a typology of actions."

A critical aspect of developing labels is developing categories and these categories are pliable. These categories are malleable because they are socially defined and are also adapted to individual circumstances. Therefore, Weick et al. (2005), explain that categories are radial in structure. They define the radio structure as a few key instances within the category that might have features that are shared with another category.

However, the category contains marginal instances that have only a limited amount of these features. Tsoukas and Chia (2002: 574) argue that this difference is potentially critical because:

> If people act on the basis of central prototypic cases within a category, then their action is stable but if they act on the basis of peripheral cases that are more equivocal in meaning, their action is more variable, more indeterminate, more likely to alter organizing and more consequential for adapting.

2.11.6 Sense-making is Retrospective

Sense-making is done retrospectively. Specifically, Weick et al. (2005) argues that sense-making is ongoing and the process is retrospective in nature. This is particularly evident when a mistake has been made because the analysis will have occurred following the mistake. This is because even though sense-making is done retrospectively the consequences of the sense that has been made are also prospective. This means that once an actor has an established sense of a particular situation they will act in accordance with this, despite often strong signals that their understanding is flawed. Paget (1988) explains that eventually mistakes will be realized retrospectively as well, (1988: 96-97) stating:

> A mistake follows an act. It identifies the character of an act in its aftermath. It names it. An act, however, is not mistake; it becomes mistaken. There is a paradox here, for seen from the inside of action, that it is from the point of view of an actor an act becomes mistaken only after it has already gone wrong. As it is unfolding, it is not becoming mistaken at all; it is becoming. When people bracket a portion of streaming circumstance and label them as a concern, a bad sign, a mistake or an opportunity, the event is at an advanced stage; the label follows after and names a completed act, but the labelling itself fails to capture the dynamics of what is happening. Because mistakes and diagnoses are known in the aftermath of activity, they are fruitfully described as complex cognitions of the experience of now and then. They identify the too-lateness of human understanding.

Furthermore, Paget (1988: 48) explains that "the now of mistakes collides with the then of acting with uncertain knowledge. Now represents the more exact science of hindsight, then the unknown future of coming into being." Paget, Weick, Pratt, Strike and Rerup argue that all sense-making occurs in the past tense. This is because we as individuals can

only examine a situation after it has already happened. However, there is some argument as to the specificity of retrospective. For example, Weick (1995) assumes speed is preferred when sense-making. Contrary to Weick, Strike and Rerup (2016) explore how slower sense-making helps in the process of mediation. Since the nature of TTOs means their employees are having to make sense of different discourses used by academics and industry as the conversation is developing, this thesis argues the term retrospective is not specific enough and will be discussed further in chapter 4 section 4.4

2.11.7 Sense-making is About Assumptions

Making sense of information is an attempt at connecting the abstract with tangible data. Paget (1988: 51) explains that in the case of medical sense-making "instances of illness are concrete, idiosyncratic and personal in their expression, and the stock of knowledge is abstract and encyclopaedic. Interpretation and extermination engage the concrete, idiosyncratic and personal with the abstract and impersonal." Weick et al. (2005) express that, based on this view explained by Paget, it is easy to miss the connection and to believe sense-making is more logical, reflexive and abstract than it really is. Sense-making thus starts with immediate actions, based on local contexts and specific cues. Additionally, Paget (1988: 143) mentions that "the work process unfolds as a series of approximations and attempts to discover an appropriate response. And because it unfolds this way, as an error-ridden activity, it requires continuous attention."

2.11.8 Sense-making is Social and Systemic which Leads to Action

Sense-making is influenced by several social factors. These social factors might include previous discussions with other work colleagues, friends, previous experiences, school, training and many other influences (Weick et al. 2005). Because sense-making is derived from many social experiences the first question according to Weick et al. (2005: 89) is usually "what's going on here?" followed by the next question which is "what do I do next?" The second question is directly linked to making an action. Sense-making with others involved in the process leads to discourse which is a constant, iteratively developed, shared understanding of the dialogue which leads to action (Weick et al. 2005). Furthermore, sense-making is actually cyclical rather than a linear operation. Discourse occurs both early on and later in the sense-making process as does the action that follows. Therefore, as Weick et al. (2005) explain, actions are a critical part of the chaos during sense-making which make them indistinguishable from one another. Action helps bring meaning to the chaos and is not, at least at the early stages of sense-making, any more significant than discourse but it does play a factor in the understanding of the information.

Weick et al. (2005) further express that sense-making is as much about thinking about what is communicated conversationally as a way of deciphering knowledge and applying this to the world around us. Moreover, making sense by acting and thinking means that people interpret knowledge based on frameworks of previous experiences. People will also mistrust these frameworks and test new ones and create new interpretations. Weick et al. (2005) also believe that ignorance and knowledge can coexist with one another and therefore adaptive sense-making both accepts and rejects past experiences. Information that is gathered within a specific moment can change, develop and also take form throughout a period of time. It is through these changes in time that a correct versus incorrect action can be revealed. These progressive changes may signal a progression from worse to better or vice versa.

2.11.9 Sense-making and Communication

Communication is a pivotal component of sense-making and how people organize the process. Taylor and Van Every (2000: 58) explain that:

> We see communication as an ongoing process of making sense of the circumstances in which people collectively find ourselves and of the events that affect them. The sense-making, to the extent that it involves communication, takes place in interactive talk and draws on the resources of language in order to formulate and exchange through talk…symbolically encoded representations of these circumstances. As this occurs, a situation is talked into existence and the basis is laid for action to deal with it.

Sense-making is therefore seen as an activity in which both communication and organization are patterns of organizing that are developed through actions and conversations which occur within social structures.

Benner (1994) argues that what is seen in communication is articulation while Winter (1987) says articulation is the social process in which knowledge becomes more usable. To share understanding with others means to take knowledge out of the implied, isolated, difficult and random to make it more clear, communal, simpler, and make it relevant to a particular situation (Obstfeld, 2004). Taylor and Van Every (2000: 33-34) share how they view articulation as:

> A situation is talked into being through the interactive exchanges of organization members to produce a view of circumstances including people, their objects, their institutions and history and their sitting [meaning location] in a finite time and place.

This happens when one person is able to convey the complexity or chaos of a situation to another person which, in turn, communicates it to someone else; essentially, explaining the chaos of a situation through one person's discourse (discussed section 2.11.3) and making the discourse functionally deployable (discussed in section 2.11.5) to someone else. Moreover, what Taylor and Van Every attempt to explain is how people try to make sense of how other people make sense of things, which is incredibly complex; however, it can become routine in an organizational environment or in this context a TTO.

2.11.10 Sensegiving and Sensebreaking

Sense-making can be applied to a variety of different contexts. It is argued by Weick (1993; 635) that sense-making is an "effort to create order and to make retrospective sense of what has occurred. When something uncertain happens people often respond by trying to make sense of things (Weick, 2001). Furthermore, sense-making is a social process and due to the collective actions of people, it is a never-ending, ongoing phenomenon, in which people can make sense of vague and unclear situations by extracting emotional and environmental cues from their surroundings and other individuals. There are several variations to the process of sense-making. Sensegiving and sensebreaking are two processes that are closely related to sense-making. Gioia and Chittipeddi (1991) explain that, particularly in an organizational setting, leaders redefine situations in order to give sense to what is happening through a process called sensegiving. Sensegiving happens when people attempt to influence another actor's sense-making process "towards a preferred redefinition of organizational reality" (Gioia and Chittipeddi, 1991; 441). People can engage in sensegiving by creating hypothetical situations, describing values and attaching labels (Bartunek et al., 1999). However, when sensegiving actors attempt to give either a new, better or more desired version of sense because it is sometimes necessary to break the old, worse or less desired versions of sense, this process becomes sensebreaking.

Pratt (2000), explains that sensebreaking is the process of breaking down others' meaning. Additionally, Lynch (2009) examines how both sense-making and sensebreaking can be created by using a sense of humour and Dougherty and Drumhell, 2006) show that rationality, emotionality and sense-making also play a role throughout the sensebreaking and sense-making process. Pratt (2000; 464) specifically describes sensebreaking as a process that involves the "destruction or breaking down of meaning." This differs from the sense-making process because there is no creation of meaning. Additionally, as sense-making helps to create identity constructions, sensebreaking involves a critical questioning of who one is when their view of themselves has been

challenged by others (Pratt. 2000). In addition, sensebreaking is similar to sense-making but is more specific in the sense it is used to describe human change, such as conflict reduction (Festinger, 1957) because the main purpose of sensebreaking is to disrupt an individual's sense of self in order to create a meaningful void that is to be fulfilled.

According to Weick et al., (2005), sensegiving and sensebreaking can become more apparent during emotional experiences. It has been expressed by Walsh and Bartunek (2011) that negative emotions may inhibit a person's sense-making ability and actors that are better at bracketing strong emotional feelings are more successful at sensegiving. Essentially, these findings suggest that people who are better at compartmentalizing their negative emotions may be more successful at giving sense to others. Sensegiving and sensebreaking work when actors are effective at communicating and when there are gaps in sense-making processes (Maitlis and Lawrence, 2007). Additionally, sensegiving and sensebreaking are more likely to occur during a chaotic time period and in situations that are highly emotional (Weick et al., 2005).

2.11.11 Mediated Sense-making

As mentioned previously sense-making is how people understand the world around them. Maitlis (2005: 21) argues that sense-making is fundamentally a "social process…where organization members interpret their environment in and through interactions with each other." However, mediators are located between local sensemakers and the larger environment. They can create and break down barriers depending on the environment they are in (Tushman, 1977). They can also help foster information and develop cues between subgroups in the local context (Obstfeld, 2005). Mediated sense-making is defined by Strike and Rerup (2016: 881) as "the process and prosocial orientation through which a mediator brings forward cues and points of view to a generated pause, doubt and inquiry among actors who are sense-making within a bounded context." Essentially mediated sense-making helps to explain how outsiders within a given scenario make sense of things.

A mediator can help sensemakers by interrupting and reversing momentum by actors by giving voice to weak cues and facilitating doubt amongst the actors (Strike and Rerup, 2016). This means that mediators have the ability to stop the conversation when they notice something is confusing for other group members involved in the sense-making process. Furthermore, they argue that mediating these interruptions is important because people that are located in a lower position within a given hierarchy can often feel fear of speaking up or not being given a voice. Additionally, by being surrounded by people who continuously give supportive information induces sensemakers to believe that everyone

within a local context agrees with their views. As Weick (2001) expresses, actors higher up in the hierarchy have little incentive to hold back and possibly distrust their knowledge, which can lead to an illusion of control and feelings of being over self-confident. By having doubt-based questioning, it encourages actors to distrust the sense that has already been made and generate new understandings (Kramer, 2007). Furthermore, Locke et al., (2008: 908) states, "doubt experienced as not knowing motivates a searching for understanding…doubts…arise when…continuance is interrupted representing a potential inadequacy in our habitual ways of understanding and acting." When sensemakers participate in doubt they question assumptions and reconsider options of the sense that has already been made. In mediated sense-making, "the mediator helps the sensemaker to think differently about the sense that has already been made" (Strike and Rerup, 2016: 882).

2.11.12 Conclusion

Sense-making is how we make sense of the world around us. We interact with many different people on a daily basis and have to make sense of each individual situation. Often our previous experiences help to influence the way we make sense of things. Sense-making in the context of this study will relate to how TTOs decipher the discourse that is being used by academics and industry. Additionally, this study will introduce the concept of mediator to the role of TTOs and their employees. Furthermore, this study will show the process of sense-making and how, in relation to this particular context of technology transfer, TTO employees communicate different discourses used by academics and industry partners.

2.12 Conclusion of the Research Context and Literature Review

As shown in the literature review a significant amount of academic research has been conducted pertaining to the need and rationale for a technology transfer office. Furthermore, a TTO often acts as a mediator between academics and practitioners because they can understand the different discourses used by both academics and practitioners; this helps them to commercialize university intellectual property by creating licenses, patents, or spin off companies. However, the area where academic research is lacking in this field is how TTOs function within the Scottish university system. Most studies have focused their empirical research (either from journal articles or PhD theses) on the United Kingdom but very few have shifted their focus only towards Scottish universities. Specifically, this aims to find the key issues Scottish TTOs face while trying to commercialize university intellectual property.

In attempting to understand the main aim of this project, the theoretical perspectives of discourse and sense-making, the literature covers a wide array and different meanings of the term discourse, along with several domains. Ultimately, the term discourse (both verbal and non-verbal through in-person conversation, email, telephone, etc.) is used as an all-encompassing term for how academics communicate with other academics and how business members communicate with other business members. One of the aims of this thesis is to understand how TTO employees make sense of discourses used by different groups of people and then communicate that information to the other group in the commercialization process.

Furthermore, sense-making was examined as a theoretical approach for this project. The literature review discusses what sense-making is, and the different modes of sense-making along with what the sense making process entails. However, there is little information as to who is doing the noticing, bracketing, labelling and categorizing during the sense-making process. It is assumed that the person who is making sense and, in this case, making sense of the discourse is the same person who is noticing, bracketing, etc. The findings chapter (4) and discussion chapter (5) will explain how in this particular set of circumstances of technology transfer, the mediator (TTO employee) is actually not the one making sense but rather they are deliberately stopping the sense-making in order for sense to be made by group members in the commercialization process.

Since the gaps in the literature have been identified in the previous paragraphs of this section, this leads to the development of the overall aims and objectives of this thesis which is to explore the field of technology transfer and to examine the strategies used to communicate between TTOs (staff members), academics, and industrial partners as they try to work together. The main aim of the thesis is to understand this process (known as the commercialization process) using sense-making theory. Furthermore, the thesis seeks to further enhance knowledge of the commercialization process by improving practice for those individuals and groups involved. Having identified gaps in the sense-making literature, the research objectives have now become:

i. Explore ways in which discourse shapes conversation between academics and industry partners and how TTOs navigate through problematic discourse.
ii. To understand how the theoretical constructs of noticing and bracketing operate in the sense-making processes which occur between academics, TTOs and industrial partners.
iii. To explore the role of mediator the process of sense-making.

In order to report the findings and discussion and how they relate to the aims and objectives of the thesis, the methodological chapter will be examined in detail first. This will explain the philosophical standpoint of the author and how the research was conducted using both ethnographic and interview methods. Additionally, how the research was analysed using various codes in accordance with the grounded theory method will also be reviewed.

Chapter 3: Research Methodology

Introduction

The aim of this chapter is to state the methods used in order to generate knowledge within a wider debate about the underlying philosophy of knowledge, thereby justifying the theoretical and methodological rationale of the thesis. The philosophy and methods used in this thesis are based around qualitative research as this was the type of research that was conducted for this project. The chapter starts by introducing interpretivist paradigm, followed by interpretivist epistemological standpoint and constructivism ontological perspective in relation to the methods used throughout the project. Introducing these frameworks helps develop an understanding of the philosophical perspective that this thesis is aligned with. In addition, theory building is also discussed in the context of inductive theory development. The aims of this research project are to build on sense-making theory based on current gaps in the literature. Furthermore, a discussion of gap spotting strategies is used to highlight the way in which the main research questions were conceived. Following the research questions, the chapter explores the merits and limitations of qualitative research before explaining the research design of the project, explaining how the data was collected and analysed. Lastly, the chapter will discuss any ethical considerations involved in the report, the validity and reliability of the findings and any limitations that could have been encountered while conducting the research.

3.1 Philosophical Standpoint

The philosophical perspective needs to be stated because it will define the beliefs, along with how the data will be collected and interpreted. The philosophical paradigm that best aligns with this thought process is the interpretive paradigm. The interpretive paradigm allows for individual consciousness and subjectivity, from the participant's perspective as opposed to perspective of the researcher of the study. Furthermore, the epistemological standpoint for this project is of an interpretivist standpoint for two reasons. Firstly, social reality has a meaning for human beings and therefore makes human action significant. Secondly, it allows for human behaviour and how they view the world. This perspective will help in the understanding of what individuals involved in this study deem important and gain knowledge from their perception. In addition, the ontological perspective of the thesis is that of constructivism because as interpretivism gains knowledge from the perception of others, constructivism tries to understand the world from how the individuals involved in this study construct meaning and therefore apply it. Additionally, this study will build on both the contextual and theoretical

orientation of the researchers that have been mentioned in the literature review. Therefore the philosophical perspectives this project aligns with will complement the methods and data collection that will be mentioned later in this chapter. Furthermore, by using sense-making, many scholars have aligned themselves with interpretivism because sense-making is the study of how people interpret or make sense of the world around them.

3.2 Paradigm

Kuhn (1970) introduced the highly influential term paradigm in relation to the analysis of revolutions in the field of science. Kuhn (1970: 175) states, "The entire constellation of beliefs, values, techniques and so on shared by members of a given [scientific] community". Furthermore, Bryman, drawing on Kuhn's definition, explains a paradigm as a "cluster of beliefs for scientists in a particular discipline influence what should be studied, how research should be done and how results should be interpreted" (Bryman, 1988: 4). Kuhn describes the natural sciences as experiencing periods of revolution that challenge existing norms by drawing attention to irregularities that are inconsistent with assumptions and established findings in the discipline specific to the time period. The growth in variances eventually contributes to a crisis within the discipline which, in turn, causes a revolution. The revolution is resolved when a new paradigm is established as the dominant one and a new period of normal science develops such as Einstein's theory of relativity which is based on Newton's laws of gravity. For example, Newton argues that there is a mysterious force that was dragging the apple down from the tree which is why it fell. Einstein challenges Newton's theory by revaluating gravity to argue that space and time are not constant (Eddington, 1922). Kuhn (1970) explains that an important feature of the paradigms is that they are impossible to measure or compare, meaning they are inconsistent with each other because of the use of different methods and assumptions.

A significant influence on understanding the epistemological and ontological foundations for business research has been Burrell and Morgan (1979). Their work is based on Kuhn (1970) from which Burrell and Morgan develop the use of the two dimensions to create four paradigms. Burrell and Morgan suggest that the two-dimensional objectivist and subjectivist reflect the assumptions that researchers make about the nature of organizations and how they are studied. The objectivist assumption is the belief that there is an external viewpoint from which it is possible to view an organization which is comprised of consistently real processes and structures. The subjectivist assumption explains that an organization is a socially constructed product, essentially a label used by individuals to make sense of their own social experience, so it

can be understood only from the viewpoint of individuals who are directly involved in its activities (Burrell and Morgan, 1979). Furthermore, each paradigm also makes assumptions about the function and purpose of scientific research while investigating the world of business as either regulatory or radical. Burrell and Morgan (1979), explaining that regulatory assumption in business research is used to describe how the organization functions, potentially suggest minor changes but do not make any judgement of it. Conversely, the radical assumption says the point of management research is to make judgements about how the business should be constructed and make suggestions on how this can be achieved.

Both of these assumptions help provide the framework necessary for the researcher to establish one of the four possible paradigms as described by Burrell and Morgan (1979). The four possible paradigms are: functionalist, interpretive, radical humanist and radical structuralist. Since, qualitative methods were used to conduct the research of this project an interpretivist paradigm was applied because it attempts to understand the world as it is and to comprehend the fundamental nature of the social world at the level of subjective experience. The paradigm tries to explain the realm of individual consciousness and subjectivity, within the frame of reference from the participant's perspective as opposed to the observer of the study. Therefore, an interpretivist questions whether organizations exist beyond the conception of social actors, so the understanding of the organization must be based on the experience of those individuals who work within them. It sees the social world as a developing social process which is created by the individuals involved in the environment. Therefore, this paradigm best represents this study as it is attempting to show how TTO employees understand different discourses used by either academic or industry partners, since it subjectively based on different individual experiences.

3.3 Epistemology

Epistemology is a theoretical perspective that explains a way of looking at the world and making sense of it. It involves knowledge and expresses a certain understanding of what is entailed in knowing, that is "how we know what we know" (Crotty, 1998: 8). Hammond and Wellington (2013: 167) explain it as "the study of the nature of human knowledge." Hamlyn (1995: 242) further states that epistemology deals with "the nature of knowledge, its possibility, scope and general basis". Moreover, Maynard (1994: 10) explains that "epistemology is concerned with providing a philosophical grounding for deciding what kinds of knowledge are possible and how we

can ensure that they are both adequate and legitimate"; meaning that researchers need to identify, explain and justify the epistemological position they have adopted.

There is a wide range of theoretical perspectives pertaining to epistemology spanning from positivism to interpretivism. Bryman and Bell (2007) explain that positivism and interpretivism are polar opposites of one another and represent the extremes of theoretical perspectives. Interpretivism is discussed as it is the epistemological standpoint of this thesis as it allows for the researcher's interpretation of the findings.

3.3.1 Interpretivism

Since, the methods used in order to conduct this research were qualitative in nature, the epistemological position for this research project was interpretivism. Schwandt (1994: 125) explains that interpretivism was conceived in order to develop a natural science of the social science. In addition, Crotty (1998: 67) says the interpretivist approach looks for "culturally derived and historically situated interpretations of the social life-world". Bryman and Bell (2003: 16) state that:

> Interpretivism is taken to denote an alternative to the positivist orthodoxy that has held sway for decades. It is predicated upon the view that a strategy is required that respects the differences between people and the objects of the natural sciences and therefore requires the social scientist to grasp the subjective meaning of social action.

Furthermore, the goal of interpretivism has been described by Hammond and Wellington (2013) as an attempt to understand the meaning and implications that cultural and institutional practices have pertaining to those individuals taking part in them. Interpretivism is often credited to the German sociologist, philosopher and economist Max Weber. He suggests that human sciences are concerned with Verstehen (understanding) and social sciences is concern with the explicative approach Erklaren (explaining). In other words, Weber describes sociology as a "science which attempts the interpretive understanding of social action in order to arrive at a causal explanation of its course and effects" (1947: 88). Weber's definition embraces both explanation and understanding but the critical difference is that task of causal explanation is undertaken with reference to the interpretive understanding of social actions of those involved in that particular social action (Bryman and Bell, 2003). Building upon Weber's concept of Verstehen or understanding is Alfred Schutz (1962: 59) who states:

> The world of nature as explored by the natural scientist does not mean anything to molecules, atoms and electrons. But the observational field of the social scientist - social reality - has specific meaning and relevance

> structure for the beings living, acting and thinking within it. By a series of common sense constructs they have pre-selected and pre-interpreted this world which they experience as the reality of their daily lives. It is these thought objects of theirs which determine their behaviour by motivating it. The thought objects constructed by the social scientist, in order to grasp this social reality, have to be founded upon the thought objects constructed by the common sense thinking of men [and women], living their daily life within the social world.

There are two points that have been made my Schutz in this quotation. Both points have been described by Bryman and Bell (2007, 2003). The first point is that there is an essential difference between the subject matter of the natural sciences and the social sciences and epistemology will reflect that difference. The critical difference is that social reality has a meaning for human beings and, therefore, makes human action significant. Therefore, humans act on the basis of the meaning that they attribute to their acts and to the acts of others. The second point made by Schutz is that the job of social scientists is to gain access to peoples' common sense thinking and interpret their actions from their social world, along with their perception. In other words, they try to see things from someone else's perspective. Bogdan and Taylor (1975: 13-14) state "The phenomenologist views human behaviour…as a product of how people interpret the world…In order to grasp the meanings of a person's behaviour, the phenomenologist attempts to see things from that person's point of view".

3.4 Ontology

Ontology and epistemology are related terms which when taken together suggest an orientation to knowledge claims. Hammond and Wellington (2013: 172) define ontology as "claims made about the nature of being and existing". They further explain that ontology is hard to imagine the world without imagining our understanding of knowledge towards the world. Crotty (1998: 10) says ontology is the study of being. Furthermore, ontology is concerned with "what is" when examining the nature of existence. Henceforth, epistemology and ontology should be a priority when shaping a research project. Hammond and Wellington (2013) explain that the understanding of what knowledge is and how to acquire it helps the researcher define the research questions along with the methodology and methods that might be used in order to conduct the project. Crotty (1998) further supports the claim made by Hammond and Wellington by stating that a project's ontology is as important as epistemology because it highlights the theoretical perspective. Each theoretical perspective exemplifies a particular way of

understanding what (ontology) is as well as a way of understanding what it means to know (epistemology). Ontology is described by Bryman and Bell (2003; 2007) as the question of whether social entities should be considered impartial entities that have a reality external to that of social actors or whether they should be considered social constructions based on perceptions and actions of social actors. Therefore, two of the main positions discussed in this thesis pertaining to ontology are objectivism and constructionism.

3.4.1 Constructivism

Constructivism is an ontological position that best aligns with interpretivism. Constructivism has been defined by Bryman and Bell (2003, 2007) as social phenomena and their meanings are constantly influenced by social actors. It implies that social phenomena and events are not only created from social interaction, they are constantly being revised. In addition, Hammond and Wellington (2013: 163) say "constructivism provides a focus on how individuals, or individuals in groups, make meaning; in contrast to behaviourism, the world is seen as made up of conceptual constructions rather than objective realities". Crotty (1998: 42) explains that "all knowledge and therefore all meaningful reality as such, is contingent upon human practices being constructed in and out of interaction between human beings and the world and developed and transmitted within essentially social contexts". This means according to the constructionist viewpoint meaning is not discovered; rather, it is constructed.

The idea and notion that accepting the world we experience, specifically prior to our experience of it, is not an easy concept. Constructionists claim that meanings are developed by human beings as they interact with the world by interpreting it. The belief among philosophers from this perspective is that before there was consciousness on earth that was capable of understanding the world, the world had no meaning at all. For example, Humphrey (1993: 17) states:

> You may object that you cannot imagine a time when nothing existed in any phenomenal form. Were there not volcanoes, and dust-storms and starlight long before there was any life on Earth? Did not the sun rise in the East and set in the West? Did not water flow downhill, and light travel faster than sound? The answer is that if you had been there, that is indeed the way the phenomena would have appeared to you. But you were not there: no one was. And because no one was there, there was not – at this mindless stage of history – anything that counted as a volcano, or a dust-storm and so on. I am not suggesting that the world had no substance to it

whatsoever. We might say, perhaps, that it is consisted of ‘world stuff’.

But the properties of this world stuff had yet to be represented by a mind. According to constructionism and the viewpoint of Humphrey, we do not create meaning, rather we construct it.

The model created by O’Gorman and MacIntosh (2015: 51), which is pictured below, best illustrates the research framework which was used during this research project. The research framework that was followed is highlighted by red circles.

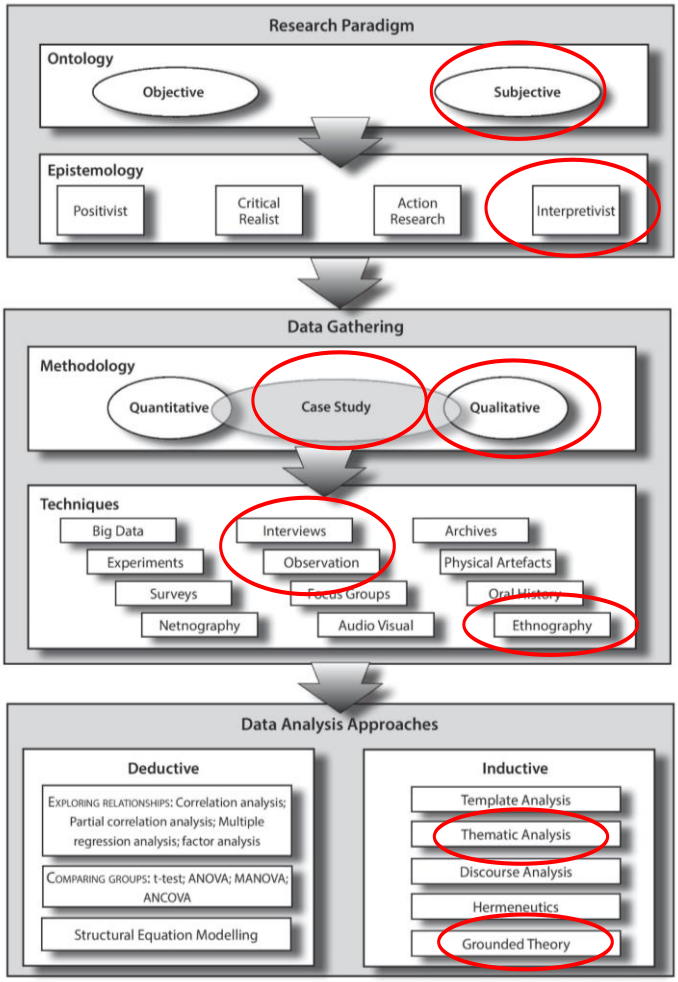

Figure 1: Method Map

Sources: Source: Adopted from O’Gorman and MacIntosh (2015: 51)

3.5 Theory Testing versus Theory Building

The challenge in any doctorate research is to demonstrate a contribution to knowledge; hence, it is important to acknowledge that the individual researcher faces two approaches to engaging with theory development: theory testing and theory building. Therefore, it would be helpful to better understand what theory is and why this project builds on theory rather than tests it.

3.5.1 What is Theory?

Theory has been described and argued in several different ways. Each definition of theory explains the role and importance differently. For example, theory is what allows scientists to comprehend and calculate outcomes of importance (Cook and Campbell, 1979; Kerlinger and Lee, 2000). Furthermore, DiMaggio (1995) and Mohr (1982) argue that theory allows for definition and clarification to a process or sequence of events. Bacharach (1989) suggests that theory prevents scholars from being overwhelmed by the complexity of the empirical world by providing a tool in order to organize it. Brief and Dukerich (1991) describe theory as something that can bring clarity to a specific set of concepts or ideas. Kerlinger and Lee (2000) explain that developing theory should be the basic aim of science.

Theory can also help provide explanations in terms of relationships. For instance, Campbell (1990: 65) states that theory is "a collection of assertions, both verbal and symbolic, that identifies what variables are important and for what reasons, specifies how they are interrelated and why, and identifies the conditions under which they should be related or not related". From this perspective, a theory is evaluated primarily by its ability to explain change in a specific area of interest (Bacharach, 1989). However, theory can also be defined in terms of narratives and accounts. DiMaggio describes theory as "an account of a social process, with emphasis on empirical tests of the plausibility of the narrative as well as careful attention to the scope conditions of the account" (1995: 391). From this perspective, a theory is examined by the wealth of its content coupled with the fact that it adds to the empirical data, and the degree to which it results in creating awareness about a particular subject (Eisenhardt, 1989).

However, Weick (1995) in the paper "What Theory is Not, Theorizing Is," argues that word theory comes from other words like guess, speculation and conjecture. Because of this broad definition that can be anything from a guess to principles to explain behaviour, Weick believes it is easier to define what theory is not. For example, Weick (1995: 389) states:

> The process of theorizing consists of activities like abstracting, generalizing, relating, selecting, explaining, synthesizing and idealizing. These ongoing activities intermittently spin out reference lists, data, lists of variables, diagrams, and lists of hypotheses. Those emergent products summarize progress, give direction and serve as place makers. They have vestiges of theory but are not themselves theories.

Even though there are multiple definitions as to what "theory" is and is not, there is even less agreement regarding the meaning of a "theoretical contribution" (Colquitt and Zapata-Phelan, 2007: 1281). There are two ways in which to make theoretical contributions to empirical articles. The first way that empirical articles can make theoretical contributions is theory testing. Hempel (1966) and Popper (1965) suggest the process of theory testing to contribute to empirical articles following the deductive model; in other words, they use theory to formulate hypotheses before testing those hypotheses with observations. The second way that scholars can make contributions to empirical articles is by theory building. Chalmers (1999) states that building theory follows the inductive model which begins with observations and are used to generate theory through inductive reasoning. For these reasons described by Chalmers (1999) is the reason why theory building and the inductive model were used throughout this research project.

3.5.2 Theory Building

Theory building explains the amount to which empirical research clarifies or increases existing theory knowledge or brings together relationships and concepts that serve as the fundamentals for a new theory. This research project is based around theory building rather than theory testing because of the key points listed below. Colquitt and Zapata-Phelan (2007: 1283) have also developed a list of criteria that serve as the basis for theory building which is comprised of five different key themes:

i. Attempts to replicate previously demonstrated effects;
ii. Examines effects that have been the subject of prior theorizing;
iii. Introduces a new mediator or moderator of an existing relationship or process;
iv. Examines a previously unexplored relationship or process;
v. Introduces a new construct (or significantly reconceptualises an existing one).

Similarly, the first three criteria are considered low-level theory building, which is more of a reporting style of input and has little theoretical contribution to empirical research. However, categories 4 and 5 represent high levels of theory building and have an extraordinary level of theoretical contribution towards empirical research.

Theory development can be considered a process. Scholars (like van der Zwaan, 1990; Yin, 1994a; Eisenhardt, 1989; van Engelen and van der Zwaan, 1994) that specialize in methodology argue that all research processes where the goal is theory development should start with a preliminary definition of the research question(s). This definition and a plan of action are necessary in order to focus the research, which is especially useful if a case study strategy is being used (Drongelen, 2001). The plan of action should be based on existing theory. However, "if theory is not, or not well,

developed as yet, then some pilot research or exploratory study is recommended (van der Zwaan, 1990: 32), for which often, but not necessarily, "an explorative case study design is chosen or pilot case" (Yin, 1994a: 52). Schuring (1997) explains that this can be problematic for the researcher because the pilot study should at the very least be a general idea of the research questions and how to conduct the research. In addition, Schuring (1997: 31) argues that this problem can be solved by a research approach that consists of a pilot study, literature search, refinement of the research question(s) and propositions (preliminary theory), followed by a new round of pilot study, additional literature search, refinement of the research question(s) and propositions, etc., until the quality of the research question(s) and research protocol is sufficiently high to conduct the 'real' research in which the preliminary theory may be validated.

Furthermore, van Engelen and van der Zwaan (1994) state, as with other research strategies that are based on theory building rather than theory testing, case study research follows what they call the empirical cycle of research which consists of five points:

i. Research question;
ii. Research design;
iii. Data collection;
iv. Data analysis;
v. Reporting.

3.5.3 Abductive, Deductive and Inductive Theory

Throughout the thesis process researchers generally fall into one of three strategic theory categories: abductive, deductive and inductive. Abductive theory is often associated with scientific methods. As mentioned previously deductive strategy is the way of linking data often associated with the quantitative research approach and philosophical standpoint. Furthermore, inductive strategy is a way of linking data usually associated with a qualitative research approach and philosophical viewpoint. Henceforth, why inductive theory was used throughout this research project because the research was built on an exploratory study which helped shape the interview selection process for the main findings.

3.5.4 Inductive Theory

Based on the philosophical perspectives and theory-building standpoint this thesis has be aligned with, this project is led in an inductive theory direction. With an inductive stance, theory is the outcome of the research (Bryman and Bell, 2003; 2007); in a broad sense they argue that observations combined with findings will generate theory as depicted n Figure 3.

Figure 2: Inductive Research Approach

Source: Adopted from Bryman and Bell (2003, 2007)

Bryman and Bell (2003) further state that the processes of induction involve concluding generalizable conclusions based on observations. An example of an inductive research project, similar to the project design used for this thesis (which will be described later in this chapter), is Sackman's (1992) article, called "Culture and Subculture: An Analysis of Organisation Knowledge". The study combined an ethnographic observation, phenomenological and clinical methods, semi-structured interviews and two different thematic content analyses (one for group interviews and the other for individual interviews). This article illustrates how research methods can be combined in order to produce an inductive theory approach to conducting scholarly works.

3.6 Gap Spotting

Over the past several decades there has been an expansion in the academic management field, resulting in large quantities of scholarly articles being published. Because of this expansion there has been an increase in the rejection rate of these scholarly articles due to limited journal space (Alvesson and Sandberg, 2013). This has led to increased competition amongst academics in order to get published. The acceptance rate has been continuously decreasing in most journals and is now as low as five percent in the top-tier management journals (Alversson and Sandberg, 2013). However, a way to resolve this issue is by making the theory more interesting and influential. The best way of solving this problem in management studies appears to be gap spotting (Alvesson and Sandberg, 2011). In gap spotting, researchers evaluate previously composed works with the purpose of extending the literature rather than formulating research questions and developing theories (Westphal and Khanna, 2003; Alvesson and Sandberg, 2013). The idea is to "fill this gap" (Luscher and Lewis, 2008: 221). Furthermore, Alvesson and Sandberg (2011: 247) argue that gap spotting means that "the assumptions underlying existing literature for the most part remain unchallenged in the formulation of the

researcher questions". In addition, they argue gap spotting is the most prevalent way of producing research questions from existing literature in management.

It is important to address that spotting gaps in the literature is rarely a simple process. Generally, it consists of a complex constructive and sometimes creative process. For example, one of the main theoretical gaps this thesis addresses are, who is doing the noticing, bracketing, labelling and categorizing during the sense-making process. As set out in the literature review, to date it has been assumed that the person who is making sense is the same person who is noticing, bracketing, etc. However, in the particular set of circumstances of technology transfer, a mediator (TTO employee) is actually not the one making sense but rather they are deliberately stopping the sense-making in order for sense to be made by group members in the commercialization process. Hence, in this specific case, the revelation of a gap emerges from the combined effects of reading the literature and spotting a hidden assumption and exploring an empirical setting which foregrounds that hidden assumption. Locke and Golden-Biddle (1997) explain that researchers commonly construct gaps by examining existing studies in specific ways. They further explain that one way to identify a gap is when a researcher "cites and draws connections between works and investigative streams not typically cited together, which suggests the existence of underdeveloped research areas" (Locke and Golden-Biddle (1997: 1030). In addition, another way to address gaps in the literature is by conducting negotiations between researchers, editors and reviewers about what is actually lacking from the existing literature (Bodeian, 2003, 2004; Tasang and Frey, 2007). Moreover, gap spotting may identify or construct narrow gaps or more significant gaps; the size or scale is not fixed, which can lead to important alterations and advances of the existing literature.

The purpose of gap spotting is to add to the existing literature rather than simply identifying or challenging existing assumptions. Johanson (2007: 292) explains "if you cannot make a convincing argument that you are filling an important gap in the literature, you will have a hard time establishing that you have a contribution to make to the literature". This research project has identified gaps in the literature by examining a previously unexplored relationship or process of how technology transfer offices translate between academics and practitioners. This will be further explained in the research questions portion of the methodology chapter.

3.7 Research Questions

By adopting sense-making theory as the overall theoretical viewpoint to focus on and help guide this study, certain theoretical concepts and relationships have shaped the conceptual framework of this research and its questions. The overall aim of this thesis is

to explore the field of technology transfer and to examine the strategies used by TTOs (along with their staff members), to communicate between academics and industrial partners as they try to work together, along with understanding this commercialization process using sense-making theory. Furthermore, the thesis seeks to further enhance knowledge of the commercialization process by improving communication strategies for those individuals and groups involved. Additionally, the research methodology will help to explore the objectives of the thesis. Having identified an inductive approach to working with qualitative data, the research objectives have now become:

i. Examine TTO discourse to understand how conversation between academics and industry partners overcome problematic discourse to arrive at collaborative relationships.
ii. Explore instances of noticing and bracketing during academic-industry interactions and build an explanation of the role of the mediator in this process.
iii. Identify specific contributions to sense-making theory which enrich the understanding of mediator roles.

3.8 Sampling

The research questions were created by sampling a population of employees that worked for a university TTO and identifying key gaps in the literature. Sampling was used as a way to narrow who the appropriate individuals were to interview for this research project. Ultimately, a sample is a portion of a population or group that is going to be studied (Tailor, 2005). The population or group does not have to represent a number of people, it can also refer to a percentage of the population or cases which are relevant to the research (Etikan et al, 2016 and Walliman, 2011). There are various types of sampling methods that could have been used during this project. However, the two most relevant methods to this study were convenience sampling and expert sampling.

Convenience sampling was used as a part of the exploratory study at a university TTO because at the time it was unknown who the experts of communicating between academics and industry partners were. Thus, convenience sampling provided the researcher with practical criteria that was needed to identify experts along with ease of accessibility, geographical closeness, availability at a particular time and the willingness to participate in the study (Dornyei, 2007). The main objective of convenience sampling is to gather information from participants that are easily accessible to the researcher and in this instance exclude individuals or subjects from the selection process (Etikan et al, 2016).

Therefore, by eliminating or excluding certain individuals that were not considered relevant from the exploratory study allowed the researcher to target specific employees of TTOs that could be considered experts in the field of both technology transfer and communicating discourse between academics and industry partners. Expert sampling is a form of purposeful sampling which is a deliberate choice by the researcher to seek a participant due to the expertise of the participant (Etkan et al, 2016). It is a non-random technique that does not require the researcher to have underlying theories or a specific number of participants. In simple terms, the researcher decides what information should be told and thus the researcher finds individuals who meet this criteria by virtue of knowledge or experience (Bernard, 2002). This involves identification and a selection of specific individuals or group of individuals that are specialists with the phenomenon of interest from the researcher (Cresswell and Plano Clark 2011). Expert sampling is typically used in qualitative based studies to select information rich individuals from available resources (Patton, 2002). This is why the participants in this study worked in the commercialization aspects of university TTOs. As they were the individuals that were identified as most likely to be experts in the commercialization process as well as being in regular contact with both academics and industry partners from the start of the process to the competition of it.

Limitations

There are several limitations to both convenience sampling and expert sampling. Even though convenience sampling is widely used in qualitative methods it is neither strategic nor purposeful (Palinkas et al. 2013). The main assumption associated with convenience sampling is that the information gathered by the researcher would be no different if the data was gathered from a similar sample (Etkan et al, 2016). Additionally, Mackey and Gass (2005) argue that this version of sampling is likely to be biased and therefore they advise that this sample size should not be a representation of the population. There are also limitations for expert sampling. These issues or limitations are generally based around subjectivity and biases of the researcher. As Sharma (2017) argues since the sample has been created on the basis of the researcher judgement it therefore can be highly prone to researcher bias. Furthermore, since the sample size is based on the subjectivity of the researcher and is non-probability based selection process it can be difficult to defend the representativeness of the sample (Sharma, 2017).

3.9 Research Design

The research design for this project is based on exploratory study because the direction of project was originally unknown. Meaning it was unclear who specifically

needed to be interviewed for the main study. Therefore, because of convenience the researcher interviewed everyone they possibly could at the university TTO office in order to discover who and what job titles could potentially be experts not only in the field of technology transfer but individuals that would have the most experience communicating between academics and industry partners. To help illustrate the research design and explain how the exploratory study influenced the main study, a diagram is shown below.

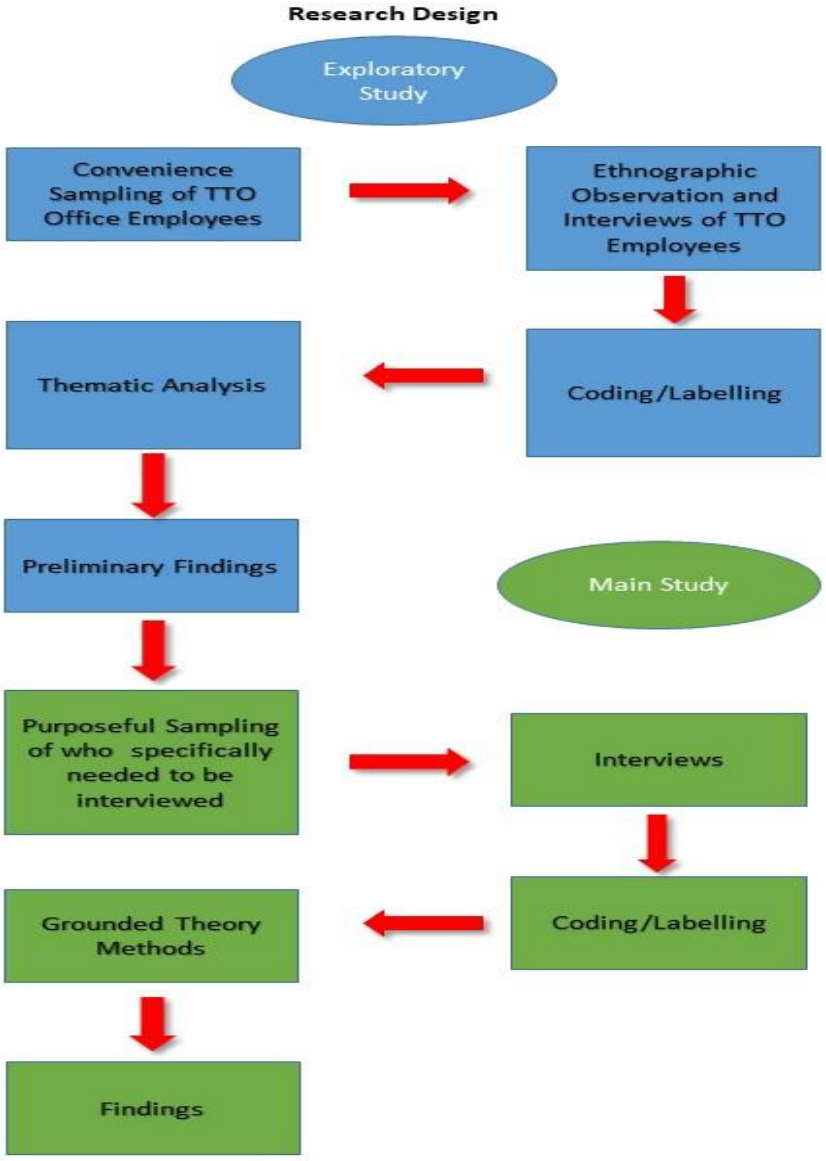

Figure 3: Research Design

Source: Own design

The first part on the research design is an exploratory case study which was conducted at a university TTO using ethnographic methods. There were two reasons for choosing this university. The first is because of the ease of access and convenience to their technology transfer office, which is called the university TTO (to keep it

anonymous). The second reason is when compared to other TTOs in Scotland this university's TTO office is one of the top five universities for commercialization. This information is shown in Table 5 and Table 6 respectively. These tables represent the number of licensing/patenting and spinout companies generated by each Scottish university. The exploratory study was conducted over a period of three weeks where, several members of staff were not only observed through ethnographic methods but also interviewed for knowledge pertaining to technology transfer and commercialization of intellectual property. By utilizing an ethnographic study, it allowed the researcher to observe how the employees of a TTO actually work and, in particular, how the commercialization process unfolds. Additionally, the researcher was able to observe and ask questions concerning how this TTO office's employees made sense of different discourses used by academics and practitioners. Both ethnographic interviews and open-ended interviews were utilized throughout the pilot study in order to explain concepts that were confusing, to gain further knowledge about a specific subject or to obtain the employees' opinions of a certain situation. During the three-week period, more than 20 people were interviewed, including various members of the university TTO staff (including managers, specialists in legal aspects, commercialization, marketing and administrative staff) and academic faculty from different departments. Observing and interviewing this many people throughout the exploratory study allowed the researcher to determine who should be interviewed for the second phase of the data collection.

The interviews were then analysed through a process of transcribing both the interviews and field notes, by coding and interpreting them and conducting a thematic analysis. Three main themes were identified:

i. Who the TTO works with;
ii. Knowledge of the TTO's existence;
iii. Communication between the university TTO and academic/industry partners.

The themes that were highlighted in the exploratory case study became the basis for the interview questions later in the research project.

University	UK Applications Filed	UK Applications published	Applications granted	EP-UK granted
University of Edinburgh	114	18	11	20
University of Glasgow	58	6	2	11
Glasgow Caledonian	5	2	1	1
University of Abertay Dundee	16	3	0	1
Glasgow School of Art	0	1	0	1
Edinburgh Napier	15	5	2	1
University of West of Scotland	4	0	0	1
Royal Conservatoire of Scotland	0	0	0	0
University of Strathclyde	68	14	6	25
University of Aberdeen	55	11	7	20
Heriot-Watt University	78	5	2	2
Scotland's Rural College	0	0	0	0

University of Stirling	0	0	0	0
University of the Highlands and Islands	0	0	0	0
University of Dundee	121	13	4	32
Queen Margret University	1	0	0	0
St. Andrews University	59	2	2	14
Robert Gordon University	1	3	5	6

Table 4: Patent Applications generated by Scottish Universities

Source: The information above was gathered from the Intellectual Property Office (Searchable Patents Journal) between March 26th, 2008 and March 12th, 2014. Available at http://www.ipo.gov.uk/types/patent/p-os/p-journal/p-pj/p-pj-ukappgrant.htm.

University	**Spinouts**	**Start-Ups**	**Others**
Edinburgh Napier University	12	1	0
Glasgow Caledonian University	4	0	0
Glasgow School of Art	0	0	0
Heriot-Watt University	30	6	3
Moredun Research Institute	0	1	0
Queen Margaret University	1	0	1
Robert Gordon University	11	2	1

Royal Conservatoire of Scotland	0	0	0
Scottish Agricultural College	0	0	0
UHI Millennium Institute	4	0	0
University of Aberdeen	28	8	0
University of Abertay Dundee	5	0	0
University of Edinburgh	71	183	7
University of Glasgow	26	20	6
St. Andrews University	20	2	0
University of Stirling	1	0	0
University of Strathclyde	59	32	5
University of West of Scotland	0	0	0

Table 5: Commercialization Chart of Scottish Universities

Source: The information gathered in this table was collected from www.spinoutsuk.co.uk on March 12th, 2014.

Interviews

For the second part of the research design, open-ended face-to-face and telephone interviews were conducted with employees of TTOs throughout Scotland. The only individuals included in the interview process were employees of Scottish TTOs not academics or industry partners. The research design of the project is to better understand the TTOs experience, not the other individuals in the commercialization process. In total there were 16 interviews conducted from 13 different universities. The interviews were conducted over a period of five months depending on the availability of the respondents. Usually, the interview time was approximately one hour. However, one interview was considerably shorter, lasting for thirty minutes and one interview lasted for over two

hours. The data was then analysed through a process of transcribing the interviews, coding and interpreting using NVivo software. The data was analysed using the grounded theory methods, which will be discussed later in this chapter.

Although the data collected from the interviews may seem small, in comparison to other PhD theses in a similar context, this is the largest data collection pertaining to Scottish technology transfer. According to the British Library service, Ethos, there are three similar contextual PhD theses in the United Kingdom. The first was a case study of the University of Strathclyde. The second was UK-based and only seven TTOs were interviewed. The third PhD study involved 23 different universities from the UK with 25 interviews, five of which were in Scotland; two were located in Wales; and 16 in England. In comparison, in the United States four PhD studies that were contextually similar. Two were survey-based ranging between 77 and 100 surveys. Another study provided three case studies of different universities. The last study conducted a total of 12 interviews.

3.10 Qualitative Research

The research methodology adopted for this study is the qualitative approach because it can provide rich data that can show relationships between people and occurrences. Furthermore, qualitative research can explain how a process happens by examining the people who were present at a particular event. However, qualitative methods cannot answer questions such as "How many?", "What are the causes?" or "What is the strength of the relationship between variables?" However, it can "provide an understanding of how official figures are created through social processes (Barbour, 2008: 11). Barbour (2008) explains that qualitative research can make mechanisms visible by linking particular variables, and by looking at the explanations, or accounts, provided by the individuals involved. In addition, qualitative research excels at significant relationships between variables, such as social class and health status or, in this study, different discourses and commercialization of intellectual property. Furthermore, quantitative analysis can explain associations by determining the relative influence of individual variables through sub-samples of the population within a particular study or by looking at the effect of clusters of related variables. However, what it does not explain is how the macro (social class position, gender, and locality) is translated into the micro (everyday practices, understandings and interactions) to guide individual behaviour. This is where qualitative research can provide a more elaborate perspective (Barbour, 2008: 11).

Moreover, qualitative methods can allow the researcher to access embedded processes by focusing on the context of people's everyday lives, such as where decisions

are made and enacted, rather than looking at the patient characteristics or the content consultations. For example, a study by Fairhurst and Huby (1998) examined how general practitioners (GPs) evaluated the results of randomized control trials in a specific area of medical practice. The study examined how GPs received new information about medical practices. Basically, the GPs relied more on the sources of evidence rather than the evidence. The study further shows GPs were more likely to accept medical findings passed on to them by someone they trusted whether it was from a highly regarded journal summarizing the findings or a respected colleague. Ultimately, the study was able to illustrate the necessity for change in how GPs received medical information regarding their own practices.

Qualitative methods can also help to explain apparently illogical behaviours. A good example of this is Graham's (1993) work on economically disadvantaged single mothers and their smoking behaviours. Considering cigarettes are expensive in both financial and health terms, smoking could not only be expensive but also considered illogical considering the circumstances. However, the study showed that smoking was relatively inexpensive, and nicotine is a powerful appetite suppressant, thus enabling the women to limit their own food intake, while providing the proper amount of food for their children.

In addition, qualitative methods can help explain apparent discrepancies, for example, Barbour's (2007) study pertaining to the low rate of formal reporting of racist incidents in one particular area of Scotland. Using qualitative methods allowed the researcher to problematize both the concept of racism and the process of reporting the incidents. The study used focus groups which showed that racism is a very complex issue and that the definition of incidents as racist are not a straightforward process, since this is embedded in multiple considerations and attributions, including perceptions of the police and legal process and the degree to which the incidents were either premeditated or intended to cause offence.

Furthermore, qualitative research can make a difficult subject easier to understand by providing detailed accounts of experience. Ethnographers often see their work as providing a "thick description" (Geertz, 1973: 5). Crombie and Davies (1996) have explained qualitative research as descriptive, using this expression in order to distinguish it from quantitative research. Qualitative research can and often does provide explanations about a particular field of study; however, it is different in terms of type and focus from quantitative studies.

3.11 Limitations of Qualitative Research

Qualitative research is not without its fair share of limitations. For the purpose of this limitations section, the main focus surrounds the limitations pertaining to observation and interviews because that is the type of qualitative research that has been conducted throughout this project. One of the limitations while conducting qualitative research concerns the limitations of observation. There is a possibility of recording events simultaneously within their spontaneous occurrence while conducting observational research. However, it is often impossible to predict the spontaneous occurrence precisely enough to enable the research to be present to observe it. Another misconception towards observational collection is that the data cannot be quantified. That is not to say that the information needs to be quantified but, according to Burns (2000: 412), for the purposes of any study, four broad questions should be answered before conducting the research:

i. What should be observed?
ii. How should observations be recorded?
iii. What procedures should be used to try to ensure the accuracy of observation?
iv. What relationship should exist between the observer and the observed, and how can such a relationship be established?

Furthermore, there is a possibility for the prejudices and attitudes of the researcher to bias the data, particularly when the data must go through the researcher's mind before it is written down on paper, this is where the issue of subjectivity can arise. How does one make interpretations about the emotional status of the people in the observation? For example, Argyle (1969) states that sticking out the tongue means an apology in some parts of China, a sign of deference in Tibet, defence against the evil eye in some parts of India, and in the Marquesan Islands the action means "No". However, there are certain universalities in emotional expression across cultures, which is why it is possible for a person from one culture to observe and learn from a person in a different culture. According to Ekman (1982), the universal expressions are fear, anger, happiness and sadness.

There is a possibility that the researcher might include some of their own biases and this may be difficult to accept and counteract in the earlier stages of project. For example, qualitative studies are not essays made after a quick observation in a particular setting or after a brief conversation with a few subjects. The researcher can spend a considerable amount of time in the setting, collecting and reviewing amounts of data. "The data must bear the weight of any interpretation, so the researcher must constantly confront their own opinions and prejudices of the data that has been collected (Burns,

2000: 415).” Furthermore, the data that is collected might provide a much more detailed experience of the events than the researcher might have imagined prior to the study.

Additionally, the primary goal of any research should be to add knowledge to the field of study, not to pass judgment on a particular setting. Qualitative researchers guard against their own biases by writing detailed field notes which include reflections on their own subjectivity. Qualitative researchers attempt to seek out their own subjectivity and the subsequent effects on their data, but they are never completely successful. Researchers can limit their own biases; however, all researchers are affected by their own observer bias (Burns, 2000).

Nevertheless, despite these limitations Sutton (1997) argues that qualitative research is appropriate for theory building. Sutton (1997), Caildini (1980), Eisenhardt (1989), Glaser and Strauss (1967), Mintzberg (1979), Van Maanen (1983) have expressed that qualitative methods allow for more flexibility pertaining to potential variables and what methods are encountered and examined. By having this flexibility in qualitative methods allows for more opportunities to learn information that is independent or different to existing theories (Sutton, 1997).

3.12 Case Study

For the exploratory study, an observational case study approach was used. Case studies usually involve the observation of an individual unit such as a student, a particular group of people such as a family group, a class, a school, a community, an event or even an entire culture group. A case study must involve the collection of extensive data in order to produce an understanding of the project being studied. Non-extensive case studies will not contribute to educational knowledge (Burns, 2000). Burns (2000: 460) further argues that there are six key purposes of the case study:

i. They (case studies) are very valuable as preliminaries to major investigations. Because they are so intensive and generate rich subjective data they may bring to light variables, phenomena, processes and relationships that deserve more intensive investigation. In this way a case study may be a source of hypotheses for future research by showing that things are so, or that such an interpretation is plausible in a particular case and therefore might be so in other cases. As a pilot study, methods, approaches or polices are tried out to observe the difficulties that need to be dealt with before the main study is attempted. Clearly, such use must assume that the case is representative in at least some ways to others, or the exercise would be pointless.

ii. Observation case studies may have the aim of probing deeply and analysing intensively the multifarious phenomena that constitute the life cycle of the unit, with a view to establish generalizations about the wider population to which the unit belongs. Case studies fit many purposes, but most case studies are based on the premise that a case can be located that is typical of many other cases. Once such a case is studied it can provide insights into the class of events from which the case has been drawn. Of course, there is no way of knowing how typical the selected case really is and it is therefore rather hazardous to draw any general conclusions.

iii. A case study may refute a universal generalization. We are considering here the critical case which is used to confirm, challenge or extend a theory. A single case can represent a significant contribution to theory building and assist in refocusing the direction of future investigations in the area.

iv. A case study may refute a universal generalization. We are considering here the critical case which is used to confirm, challenge or extend a theory. A single case can represent a significant contribution to theory building and assist in refocusing the direction of future investigations in the area.

v. A case study is preferred when the relevant behaviours cannot be manipulated.

vi. A case study may be valuable in its own right as a unique case. This is often the position in clinical psychology or in special education, where a specific disorder, behaviour manifestation or physical disability is worth documenting and analysing; or in a school setting where an occasional event such as a teacher being charged with assault of a pupil, or planning of shared resources by a primary and secondary school on the same site would be of interest. The case study may be the possible source of description of unique historical material about a particular case seen as inherently interesting in its own right.

There are two main approaches to conducting case study research. The first approach is developed from the ensuing works of Robert K. Yin (1994a: 13) who defines case study research as “an empirical enquiry that investigates a contemporary phenomenon with its real-life context, especially when the boundaries between phenomenon and context are not clearly evident”. Furthermore, Yin (1994b) explains case studies allow the researcher to understand complex social phenomena and create meaningful characteristics of real-life events. Yin seems to be leaning more towards positivistic epistemological philosophy while conducting case study research. Crotty (1998) suggests that there are three fundamental positivistic aspects when conducting

research, objectivity, validity and generalizability. Crotty's (1998: 41) viewpoint towards research is grounded in positivism, as he states,"established facts, or at least as close to established fact as their (the scholar) research has enabled them to reach." Yin does not specifically articulate his philosophical standpoint but his approach to conducting research in general, along with his case studies, suggests that he is leaning towards a positivistic point of view (Yazan, 2015).

The second approach to conducting case study research and the technique that was used for this research project has been based on Stake's subsequent works. Stake's (1995) definition of case study agrees with Louis Smith's (1978: 2) definition of case study in which researchers should view a case study as "a bounded system" and inquire into it "as an object rather than a process." Smith (1978: 2) further defines the case study as "a specific, a complex, function thing," more specifically "an integrated system" which "has a boundary and working parts" and effective and useful in social sciences and human in services. Moreover, Stake describes four defining characteristics of qualitative research which are important for qualitative case studies: holistic, empirical, interpretive and emphatic. Specially, Stake's (1995: xi) book The Art of Case Study Research, explains the fundamental purpose of his book is the explication of a set of interpretive orientations towards case study which include "naturalistic, holistic, ethnographic, phenomenological, and biographic research methods." This statement outlines his epistemological standpoint which states "case study researchers should contribute to reader experiences depends on their notions of knowledge and reality" (Stake, 1995: 100). From Stake's viewpoint, constructivism and existentialism should be epistemologies that inform the qualitative case study research since "most contemporary qualitative research hold that knowledge is constructed rather than discovered (Stake, 1995: 99).

As mentioned previously in section 3.3.1, an interpretivist gains knowledge from the perception of others while a constructivist tries to understand the world from how the individuals involved in this study construct meaning and therefore apply it. This project has an epistemological standpoint of interpretivism, and the ontological perspective of constructivism follows Stake's approach of conducting case study research; therefore, it is the methodology that will be followed throughout the observational case study.

3.13 Observational case study

An observational case study is a study of a real-world case without performing an intervention (Wieringa, 2014). A more in-depth description of the observational case study has been defined by Cochran and Chambers (1965) as conducting an observational case study to clarify cause and effect relationships which is not feasible to control in an

experimental environment. Observational case studies are used by academics to study phenomena that cannot be produced in the laboratory. Because the researcher does not interfere, observational case studies are a useful research method for implementation evaluation and problem investigation. In other words, the researcher investigates the real world as they find it. The researcher may study a sample of two or even more cases throughout the overall project; however, the goal of case study research is not to acquire knowledge about samples, but about individual cases (Wieringa, 2014).

Limitations of case studies

As when using any form of method, there are limitations. Some of these limitations are repetitive because of the nature of conducting qualitative research but they still need to be mentioned. Burns (2000) provides a list of issues when conducting a case study approach. They are:

i. Subjective bias
ii. Generalization
iii. Time and information overload
iv. Reliability
v. Validity
vi. Rigour

Langley and Royer (2006) argue that later in the research process, maintaining quality relationships with participants in case study research can be a major concern for researchers because it can cause anxiety and affect the behaviour of the researcher. Additionally, they suggest that in order to facilitate relationships, researchers may alter their identity in order to match the people with whom they are trying to build those relationships. Matching these identities with participants in the case study can be based on previous professional experience, local culture or religion. Lastly, Langley and Royer (2006) argue that researchers will instinctively adopt the behaviours and roles that might be expected of them, which may influence the data in a particular way.

3.14 Ethnography

Ethnography was used for the exploratory study because it has become a more readily used tool than participant observation. This is for two reasons. The first reason is that the term underlines that observation is just one of the techniques used in the field and is complemented by many other ways of collecting data. This includes conducting interviews, reading documents, observing images, etc. The second reason is, the term more strongly highlights the part of the writing that focuses on the fieldwork for the research as a whole (Flick, 2014). For example, Gobo (2008: 12) describes ethnography

as showing both the centrality of (participant) observation and how ethnography goes beyond observation as "a methodology which privileges (the cognitive mode of) observation as its primary source of information". This purpose is also served, in a secondary and ancillary manner, by the other sources of information used by ethnographers in the field: informal conversations, individual or group interviews and documentary materials (diaries, letters, essays, organizational documents, newspapers, photographs and audio-visual aids). Ethnography comprises two research strategies: non-participant observation and participant observation.

Furthermore, because ethnography observation and participation are interwoven together mixed with other procedures Hammersley and Atkinson (1995: 1) describe ethnography as:

> In its most characteristic form it involves the ethnographer participating, overtly or covertly, in people's daily lives for an extended period of time, watching what happens, listening to what is said, asking questions – in fact, collecting whatever data are available to throw light on the issues that are the focus of the research.

Even though an ethnographic project is subject to the researcher's interpretation of what they are observing, some key features to having a successful study have been outlined by Atkinson and Hammersley (1998: 110-11); they describe several substantial components of ethnographic research:

i. A strong emphasis on exploring the nature of a particular social phenomenon, rather than setting out to test hypotheses about them.
ii. A tendency to work primarily with "unstructured" data: that is, data that have not been coded at the point of data collection in terms of a closed set of analytic categories.
iii. Investigation of a small number of cases, perhaps just one case in detail.
iv. Analysis of data that involves explicit interpretation of the meanings and functions of human actions, the product of which mainly takes the form of verbal descriptions and explanations, with quantification and statistical analysis playing a subordinate role at most.

Moreover, Geetz (1973) explains that observation studies with detailed field notes can provide 'thick descriptions' of the field, meaning, a detailed set of accounts that allows the reader to gain insight on any particular settings, situations or feelings the researcher might be experiencing.

3.15 Limitations

Even though ethnography is a viable method in order to collect data it is not without its fair share of limitations. According to Sangasubana (2011) there are two key questions that need to be assessed before using ethnography as a research method: 1) how does the research control quality in ethnographic research; and, 2) when or why should we not conduct or use ethnography. In order to address the first question there are three issues that need to be considered when you control for quality in ethnographic research: reactivity, reliability and validity.

Reactivity is defined by Neuman (2003) as the degree to which the researcher's presence influences the behaviours of others because they know they are in a study and this may cause those under study to act differently. However, Neuman further states that in order to reduce reactivity the researcher needs to be as unobtrusive or disruptive as possible and familiarizing yourself with the lives of others as much as possible.

Neuman (2003) describes reliability in the field as addressing the question of whether the researcher is able to collect the data that is consistent, and credible. Data can become consistent when the researcher records behaviours over time and in different social settings. Furthermore, data can achieve consistency by verification or cross-check against other sources if they are available. Ethnographic researchers also depend on what people (informants) tell them; therefore, credibility of the information needs to be evaluated. The information shared with the researcher could be misinformation, evasions, lies, opinions and omissions. Reliability in the field will depend upon the researcher's insight, awareness and questions while observing behaviours and events from different angles and perspectives (Neuman, 2003).

Validity in the field is based on the researcher's ability to accurately collect and analyse data representing the lives or culture in the study (Neuman, 2003). Neuman (2003) further states that validity can be evaluated in a number of ways. Two of these ways are through ecological validity and natural history. Ecological validity is the degree to which the data collected and described by the researcher reflects the world of those involved in the study. Natural history is a full description and disclosure of the researcher's actions, assumptions, and procedures for others to evaluate. This can include people involved in the study, along with people outside of the project. If the study is considered credible to others inside and outside the study, it is valid in terms of the natural history. Neuman (2003) suggests that the researcher should also check with a member involved with the study to validate the field results for adequacy and accuracy from their perspectives. Additionally, Neuman (2003) states, the researcher should have competent

insider performance which is the ability of the researcher as a no-member of the group or culture under study to interact effectively as and with the members. Finally, the study should have transferability to other areas, meaning the degree to which the study results and conclusions have relevance beyond the project itself (Angrosino, 2007).

Furthermore, the question of validity stems from whether researchers see what they think they see. According to Kirk and Miller (1986: 29-30), there are three basic errors that can occur when researchers:

i. See relationships where there are none or identify relationships inaccurately
ii. Reject them when they are, indeed, correct
iii. Ask the wrong questions.

The problem with assessing validity in qualitative research is how to specify the link between relationships that are studied, and the version provided by the researcher (Flick, 2014). Flick (2014) further argues that this implies there is less of an assumption that a reality exists independently of social constructions (i.e., perceptions, interpretations and presentations) developed from the researcher are different from those the researcher is observing. As Hammersley (1992: 50-52) describes, the definition of "subtle realism" is based on three concepts:

i. The validity of knowledge cannot be assessed with certainty: assumptions should be assessed on the basis of their plausibility and credibility.
ii. Phenomena also exist independently of our claims concerning them: our assumptions about them can only approximate to these phenomena.
iii. Reality becomes accessible across the different perspectives on phenomena.

Therefore, research is aimed at presenting reality, not reproducing it. Henceforth, validity as a concept to the wider concern of philosophical positioning would greatly affect research with a positivist viewpoint but does not affect social constructionist or interpretivist viewpoints.

In addition to the limitations of conducting an ethnographic study there are also several disadvantages to conducting this type of research. Since most ethnographic research requires fieldwork, it also faces the same limitations that field or observational research has (Singleton and Straits, 2005). Ethnographic research has the potential to be very labour intensive and time consuming. Also, balancing the requirements of both participating and observing can be very difficult. As the researcher becomes more familiar with the setting and groups involved in the study, sometimes the investigator develops an attachment, empathy for, trust and rapport with those involved in the study. Consequently, the researcher may be drawn into the lives of those people more as a participant than as

an observer. When a researcher becomes fully immersed in a culture or situation, there is a risk of changing the events the researcher has observed, or participated in and, perhaps, even losing sight of the role as a researcher, thereby "going native" and over-identifying with the group under study (Singleton and Straits, 2005).

Another disadvantage of conducting an ethnographic study is that fieldwork lacks the level of structure and control displayed in a laboratory type environment that can help ensure objectivity. The researcher's personal values and attitudes may lead to bias. Due to the volume of data collected, the researcher may experience difficulty in both data analysis and interpretation (Roper and Shapira, 2000). The ethnographic researcher also needs to adapt and have the ability to know how to stay safe in unsafe scenarios, learn the culture, and manage personal stress and conflicts in the field (Neuman, 2003). Furthermore, because of the nature while conducting field research that personally involves any researcher in the social lives of other people, there are ethical dilemmas that need to be considered. These issues include confidentiality and privacy; unintentional revelation of identities; deception and misrepresentation of the researcher; identification of researcher biases; any involvement with illegal behaviour or activity; violation of the researcher's own basic personal moral standards in order to conform; identification with those lacking power in the society or culture; negotiations with the elite in power or authority; and publishing field reports that may be truthful but unflattering (Sangasubana, 2011; Angrosino, 2007; Neuman, 2003).

3.16 Interviews

For the purpose of this project, there were two different styles of interviews taking place. The first is open-ended interviewing (also known as in-depth interviewing), which was used for the main study of the thesis and the other is ethnographic interview, which was used during the exploratory study. The open-ended interviewing process is a conversation between the informant and the researcher. The interview is unstructured and focuses mainly on the informant's perception of themselves, their environment and experiences. There is no standardized list of questions involved in the process; it is simply a free-flowing conversation, relying on the quality of the social interaction between the investigator and informant, which can be redirected by the interviewer if the conversation is moving too far from the subject matter. Even though the interview process should be as natural as possible, the direction of the conversation should be somewhat controlled to ensure the focus remains relevant to the study. According to Burns (2000: 425-426) open-ended interviewing should be employed when:

i. It should be used to obtain an individual's subjective experiences when a life or oral history is being elicited. The individual's subjective life experiences are reported in the individual's own language in a case study approach. This evidence is often combined with the study of documents, photographs, letters and other personal effects.
ii. It facilitates access to events and activities that cannot be directly observed by the researcher because perhaps they occurred in the past.
iii. In variant of the first point, it can be used in a clinical interview to obtain a case history for counselling or medical purposes.
iv. It enables more subjects to be studied in detail than participant observation.
v. It can also be used in a group interview context where the form would be an open-ended group discussion. Group dynamics can be studied in this way too.

However, open-ended interviews seem closely related to the ethnographic interview. For example, Spradley (1979: 58-59) states that:

> It is best to think of ethnographic interviews as a series of friendly conversations into which the researcher slowly introduces new ethnographic elements (such as asking questions, expressing interest, avoiding repetition and expressing ignorance) to assist informants to respond as informants. Exclusive use of these new ethnographic elements or introducing them too quickly will make interviews become like a formal interrogation. Rapport will evaporate, and informants may discontinue their co-operation.

One of the differences between the two interview techniques is that frameworks are less clearly defined than in other interview situations, where the time and place are arranged specifically in order for the interview to take place. In an ethnographic interview the conversation can often occur spontaneously and surprisingly from regular fieldwork. In addition, Spradley (1979: 59-60) comments that ethnographic interviews include the following elements that separate the process from more than "friendly conversations":

i. A specific request to hold the interview (resulting from the research question;
ii. ethnographic explanations in which the interviewer explains the project (why an interview at all) or noting of certain statements (why he or she notes what); these are completed by everyday language explanations (with the aim that informants present relations in their own discourse), interview explanations (making clear why this specific form of talking is chosen, with the aim that the informant gets

involved), and explanations for certain (types of) questions, explicitly introducing the way of asking;

iii. ethnographic questions, that is, descriptive questions, structural questions (answering them should show how informants organize their knowledge about the issue), and contrast questions (they should provide information about the meaning dimensions used by informants to differentiate objects and events in their world).

3.17 Limitations

The limitations for both open-ended and ethnographic interviews are generally the same. A major limitation of conducting both styles of interviews is that the researcher is subject to the informant's interpretation and presentation of reality. Also, the general problem of making and maintaining interview situations is often unreliable because of the open framework and often certain circumstances will need to be clarified outside of the actual interview (Burns, 2000 and Flick, 2014). Furthermore, Alvesson (2003: 16) discusses several problems with interviews and states: "respondents may produce only superficial and cautious responses.

Additionally, the limitations can also be because of the interviewer and their own personal biases. For example, Hardy and Clegg (1997) explain that the researcher is part of the social world that is studied and therefore the researcher should be aware of their own biases and should conduct their own self-examination. They state:

> Acutely aware of the social and historical positioning of all subjects and the particular frameworks through which they are rendered visible, the researcher can only produce knowledge ready embedded in the power of those very frameworks (Hardy and Clegg, 1997: 5).

Therefore, Alvesson (2003) argues that this sometimes leads to a researcher dominating the study by writing and placing their personal experience as the focal point of the study or various accounts of the researchers' selves that have participated in the process (Reinharz, 1997). As a potential worst-case scenario, this can lead to a researcher feeling obliged "to give a cleansing account of their positions, preconceptions and interests (Lee and Hassard, 1999: 396)."

3.18 Data Analysis

Flick (2014) describes qualitative data analysis as in interpretation and classification of linguistic or visual matter. Moreover, there are specific aims when analysing the data which are to make statements about implicit and explicit dimensions and structures that are comprised of the data and how it is represented, meaning that the data can refer to subjective or social meanings. Flick (2014) further states that qualitative

data analysis combines a rough analysis comprising overviews, condensation, and summaries along with a detailed analysis consisting of development of categories or hermeneutic interpretations. The overall goal of the analysis is to develop statements that can be generalized by comparing several materials, text or cases. Since, there were two separate studies conducted for this research project, the exploratory case study and the main study, there are two different types of analysis that were conducted.

Data Analysis of Exploratory Study

As mentioned previously the data analysis of the exploratory study was conducted before the main study was conducted. The process of analysing the exploratory study started with understanding and analysing the ethnographic field notes that had been taken by the researcher along with the interviews of TTO employees followed by coding and interpretation of the interviews. A thematic analysis was conducted from the data collected from the exploratory study in order understand how TTOs make sense of different discourses in order to facilitate communication between academics and industry.

3.19 Transcribing field notes and interviews

After each ethnographic session and interviews has taken place the researcher transcribed the qualitative data. This was the first step in the analysis process. This process included taking the field notes (some of the field notes can be seen in Appendix A), along with any audio-recorded sessions, interviews and reproducing them into written words (a sample of this can be viewed in Appendix B). Saunders et al. (2007) state that the process of transcription is likely to be time consuming because the researcher needs to record exactly what was said and by whom, but also give an indication of the tone in which it was said coupled with the participants' non-verbal discourses.

3.19.1 Coding

There are many different meanings to the phrase coding, but the basic principle remains the same, it is used to describe the relationship by formulating categories generated in the analysis. When using grounded theory in research, coding has been defined as "naming segments of data with a label that simultaneously categorizes, summarizes and accounts for each piece of data" (Charmaz, 2006: 43). For qualitative content analysis Schreier (2014: 171) explains that coding "is also systematic in that it requires codes (i.e., assigning segments of the material to the categories of the coding frame) to be carried out twice (double-coding), at least for parts of the material".

In ethnographic interviews, coding has been described by Blumer (1970: 57) as "sensitizing concepts". Blumer further explains the difference between definitive and sensitizing concepts. Definitive concepts "refer precisely to what is common to a class of

objects, by the aid of the clear definition of attributes or fixed benchmarks" (Blumer 1970: 57) A sensitizing concept "gives the user a general sense of reference and guidelines in approaching empirical instances. Where definitive concepts provide prescriptions of what to see, sensitizing concepts merely suggest directions along which to look" (Blumer 1970: 57). Blumer further argues that qualitative content analysis aligns itself more with definitive concepts and ethnographic study aligns itself more with sensitizing concepts; in other words, qualitative analysis is ideally based on mutually exclusive categories but in ethnographic research the process of coding is much more flexible. For example:

> We code [the field notes] inclusively, that is to say, if we have any reason to think that anything might go under the heading, we will put it in. We do not lose anything. We also code them in multiple categories, under anything that might be felt to be cogent (Becker, 1968: 245, quoted from Hammersley and Atkinson 2007: 153).

The purpose of trying to code information is to begin moving methodically to a slightly higher theoretical level. Data that seems to be similar should be assigned the same code. Once this action has been completed a higher conceptual level will enable the researcher to later sort the material into different groups. Once everything is sorted the researcher can examine the related features of these groups and gain insight into them (Yin, 2011). This process is then followed by interpretation of the data which is how the scholar can understand and explain what the coding has revealed about the study in the field, their links amongst one another, their ties to context conditions and so forth (Flick, 2014).

The coding that was used to start the analysis for the exploratory study can be viewed in the three pictures below. Each picture represents an interview with a different TTO employee from the same university. The highlights and pen marks represent a different code that was given to each interview transcript. In picture 2 below there are several different coding elements that are happening on the page. The green highlighter represents mutual understanding between academics and industry partners. The blue highlighter representing both meeting styles of the TTO employee such as face to face meetings and also illustrates the necessity for mutual understanding in a conversation between academics and industry partners. Lastly, the orange highlighter was used to demonstrate areas when a TTO employee stated they needed information to be simplified or Dumbed Down.

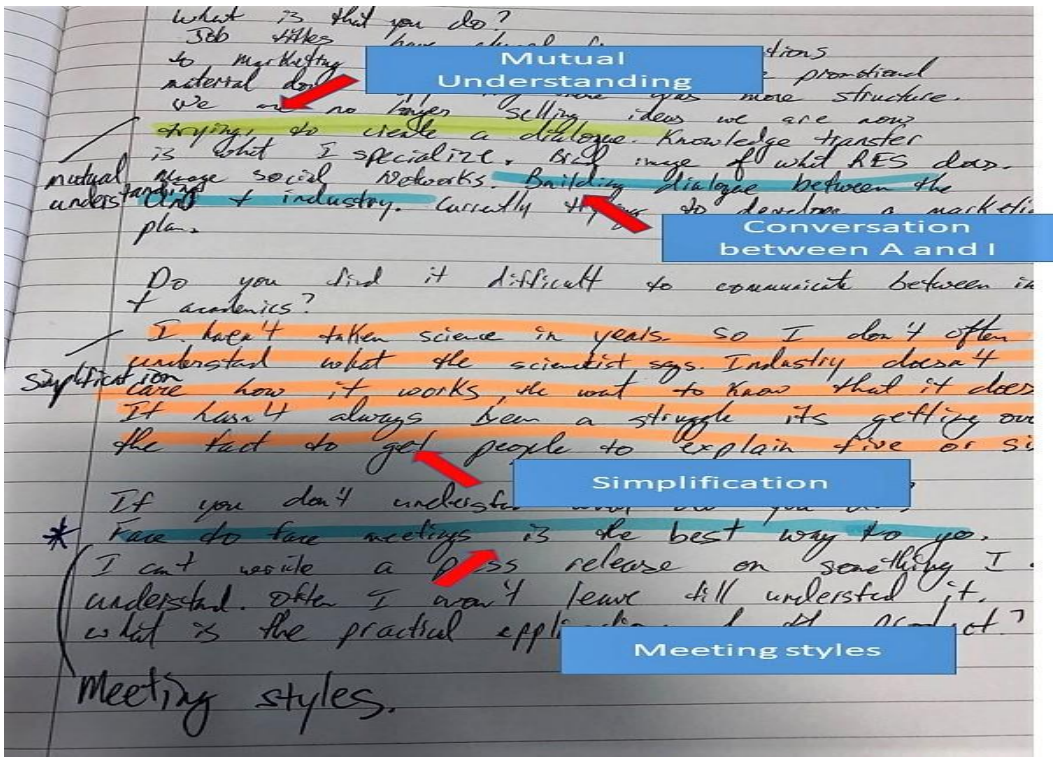

Figure: 4 Exploratory Case Study Coding 1

Source: Own field notes

The next image posted below (picture 3) adds other elements to the coding process. For example, the box drawn in pen around paragraph three demonstrates how the TTO employee feels about their perceived role in view of either the academics or industry partners. Furthermore, the blue highlighter again represents another instance of meeting styles of the TTO employee pertaining to meeting the academic and industry partners. The green box around this paragraph is actually a mistake on the researcher's part by using the wrong coding and having to go back and correct the mistake.

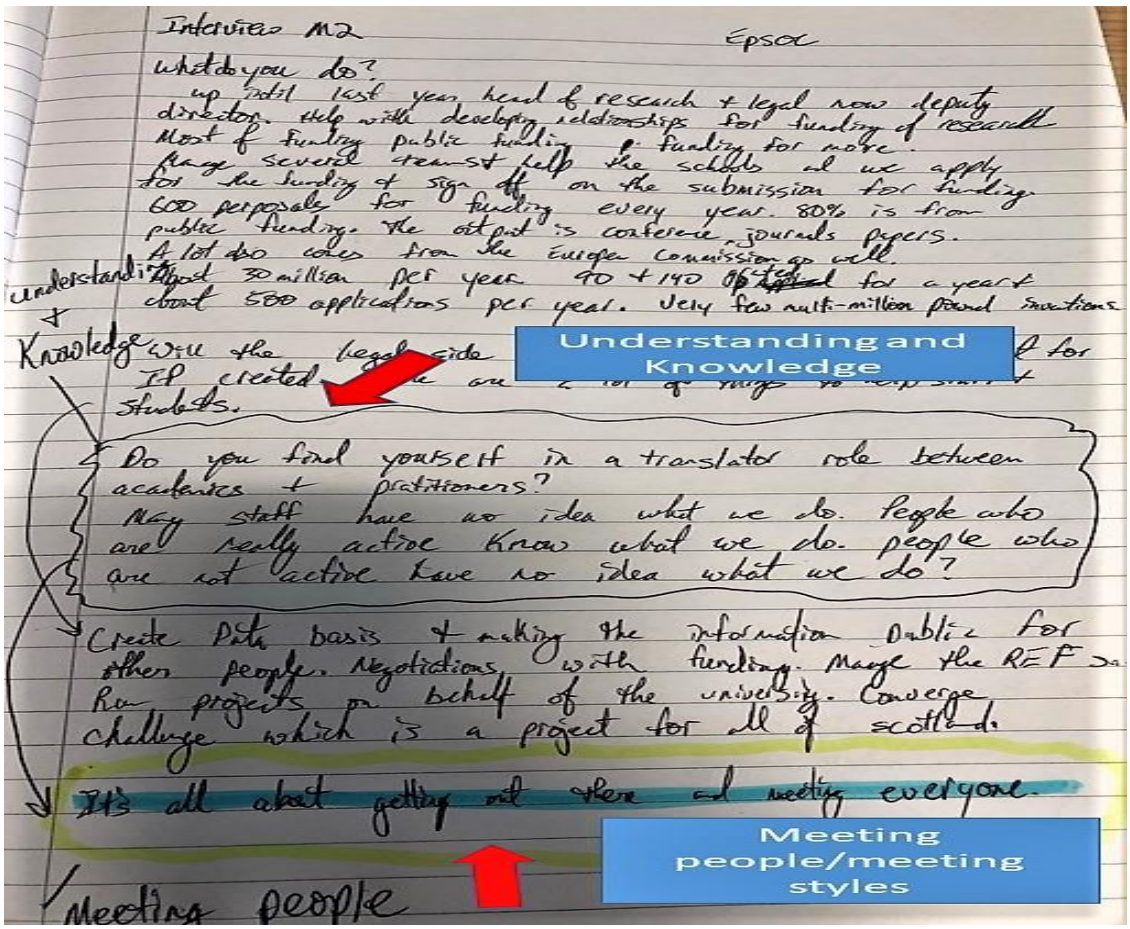

Figure: 5 Exploratory Case Study Coding 2

Source: Own field notes

3.19.2 Interpretation

Once the codes had been completed it was then necessary to start on the interpretation of the codes. In analysing qualitative data, interpretation is the understanding or explanation of what information has been collected in the data. Flick (2014: 375) says, "interpretation means to understand the internal logic of an excerpt of the data or to put it into context. Willig (2014b: 136) states:

Interpretation is the challenge at the heart of qualitative research. Without interpretation, we cannot make sense of our data. As qualitative researchers, we aim to find out more about people's experiences, their thoughts, feelings and social practices. To achieve this aim, we need to ask questions about their meaning and significance; we need to make connections between different components and aspects of the data in order to increase our understanding. In other words, we need to make the data meaning through a process of interpretation. Interpretation is essentially the researcher's perception of what is going on in the field work they are observing.

The interpretation of the codes is best demonstrated through the end results of the thematic analysis. This is because the researcher is able to demonstrate both a starting point in the analysis along with an endpoint.

3.19.3 Thematic Analysis

In order to begin to understand how TTOs make sense of different discourses used by academics and industry, in order to facilitate communication between them, a thematic analysis was used to highlight important trends throughout the exploratory study. The themes that were identified in the analysis were based on the ethnographic interview responses from the university's TTO office as to how they communicated the different discourses used by multiple groups of people. Braun and Clarke (2006: 79) define a thematic analysis as: "a method for identifying, analysing and reporting patterns, (themes) within data. It minimally organizes and describes your data set in (rich) detail. However, frequently it goes further than this and interprets various aspects of the research topic". When conducting a thematic analysis, it is different from other approaches in several ways. It does not build a new theory (Grounded Theory), nor does it use a set of codes that have been developed before and after the data collection process has been completed (template analysis). In addition, it does not focus on the use or interpret the use of language (discourse analysis) and does not pay any special attention to the symbolic meaning of communication (hermeneutics) (Sang and Sitko, 2014 through O'Gorman and MacIntosh, 2014). It simply identifies themes that have been collected from the researcher's data.

In addition, Braun and Clarke (2006: 87-93) explain a thematic analysis can be developed by following six steps:

i. Familiarizing yourself with your data.
ii. Generating initial codes.
iii. Searching for themes.
iv. Reviewing themes.
v. Defining and naming themes.
vi. Producing the report.

Based on the data gathered from numerous interviews a thematic analysis was performed which identified three separate threads. Codes were then given to these themes as follows: Who TTOs work with; awareness of the TTOs services; and communication between the TTO and academic/industry partners. A summary of these findings is illustrated in the table below.

Codes	Description	Themes
1) Communication 2) Miscommunication 3) Asking for clarification 4) Using metaphors or examples 5) Mutual understanding 6) Meeting styles 7) Understanding and knowledge 8) Meeting people/meeting styles 9) Confusion	These were codes that were given when the TTO employees were describing their experiences in communicating along with understanding discourse that was used between academics and industry partners. Some of these codes that were discovered in the interviews became important the main study. Asking for clarification is one of these codes because in the main study it was the basis for the concept of dumbing down information.	Communication between academics and industry partners
1) Questions like "what do you do?" 2) Lack of knowledge 3) No idea 4) Confusion about job role	These codes were derived during the interview process when the TTO employees would describe how felt they were viewed by either academic or industry partners.	Awareness of TTOs Services
1) Job roles 2) Job responsibilities 3) Funding bodies 4) Research Alliances 5) Scottish Government 6) Businesses 7) Regulatory bodies 8) Legal	When describing the various job roles and responsibilities of different TTO employees several suggested that they worked with a variety of different people. Since, that was what was required of them to perform their job, the research was able to begin to understand how many different discourses TTO employees needed to use on a daily basis. This also led to a wider understanding of how many different groups of people TTO employees work with.	Who TTOs work with

Table 6: Themes for Exploratory Study

Source: Own material

3.20 Data Analysis of Main Study

As mentioned previously, grounded theory methods were used in order to conduct the main interview analysis of this thesis. In this section grounded theory methods will be covered in the forms of coding which will include open, selective and theoretical coding, along with different variations (Glaserian and Straussian). Additionally, this section of the methodology will also describe the codes that were generated throughout the various aspects of Glaserian grounded theory methods through using NVivo software.

3.20.1 Grounded Theory Method

Grounded theory methods consist of organized but flexible guidelines for collecting and analysing qualitative data in order to construct theories from that data. As Charmaz (2014:1) explains, "grounded theory begins with inductive data, invokes iterative strategies of going back and forth between data analysis, uses comparative methods and keeps you interacting and involved with your data and emerging analysis." Furthermore, Atkinson et, al. (2003) state that grounded theory methods assist the researcher by providing a general set of principles, guidelines, strategies and heuristic devices instead of providing prescribed instructions.

Similar to thematic analysis, coding is a critical part of the process. However, the method is vastly different. As Charmaz (2014: 113) shares:

> Coding is the pivotal link between collecting data and developing an emergent theory to explain these data. Through coding, the researcher defines what is happening in the data and begins to grapple with what it means. The codes take form together as elements of a nascent theory that explains these data and directs further data gathering.

Coding in grounded theory allows the researcher to generalize theoretical statements of specific times and places, coupled with contextual analyses of actions and events.

Furthermore, there are two different styles of coding. The first is called bottom-up coding, which is when the codes are based on the data collected by the researcher, not the literature. This was the style of coding used in this project. The second is called top-down coding. In top-down coding the codes are derived from the literature and applied to the data. This means, the codes are generated from the literature not the data.

Additionally, coding for grounded theory is the foundation of the researchers' analysis. Therefore, coding is more than a starting point for analysis; rather, it shapes the analytic framework from which the researcher develops the analysis. Grounded theory codes can be developed into two main phases. The first is an initial phase, which involves generalized naming of each word, line or segment. The second phase is a more focused

selective phase which is used to highlight more significant or frequently used initial codes to sort or integrate large amounts of data (Charmaz, 2014).

3.20.2 Glaserian versus Straussian

As mentioned previously there are two main variations of grounded theory methods. The reason for the two different variations is because the founders, Strauss and Glaser had a disagreement pertaining to the coding structure. Strauss and Corbin (1990) suggest breaking down the coding process into four steps which consist of: open, axial, selective and coding for process. Meanwhile, Glaser uses three codes, open, selective and theoretical coding (Urquhart, 2013). An example of the main differences between Glaserian and Straussian grounded theory methods was composed by Jones and Alony (2011) and is listed in Figure 4. This research project used the Glaserian version of grounded theory as it is more flexible and Urquhart (2013) further argues that the Glaserian version is easier to manage than the Straussian version of grounded theory.

Glaserian	Straussian
Beginning with general wonderment (an empty mind)	Having a general idea of where to begin
Emerging theory, with neutral questions	Forcing the theory, with structured questions
Development of a conceptual theory	Conceptual description (description of situations
Theoretical sensitivity (the ability to perceive variables and relationships) comes from immersion in the data	Theoretical sensitivity comes from methods and tools
The theory is grounded in the data	The theory is interpreted by the observer
The credibility of the theory, or verification, is derived from its grounding in the data	The credibility of the theory comes from the rigor of the method
A basic social process should be identified	Basic social process need not be identified
The research is passive, exhibiting disciplined restraint	The researcher is active
Data reveals the theory	Data is structured to reveal the theory
Coding is less rigorous, a constant comparison of incident to incident, with neutral questions and categories and properties evolving. Take care not to 'over conceptualize', identify key points	Coding is more rigorous and defined by techniques. The nature of making comparisons varies with the coding technique. Labels are carefully crafted at the time. Codes are derived from 'micro-analysis which consists of analysis data word-by-word'
Two coding phases or types, simple (fracture the data then conceptually group it) and substantive (open or selective, to produce categories and properties)	Three types of coding, open (identifying, naming, categorizing and describing phenomena), axial (the process of relating codes to each other) and selective (choosing a care category and relating other categories to that)
Regarded by some as the only 'true' GTM	Regarded by some as a form of qualitative data analysis (QDA)

Figure 7: Main Perspectives on Grounded Theory Method

Source: Adopted from Jones and Alony (2011)

3.20.3 Open Coding

The first step in grounded theory is open coding. Glaser (1978) first mentioned open coding in his book Theoretical Sensitivity: Advances in the methodology of grounded theory. Glaser (1978: 56) describes open coding as "coding the data every way possible." It is the first stage in coding for grounded theory methods because the idea is open the data and does not shut down any indications as to where future theory might lead. Open coding includes giving the data initial labels, which are then grouped into codes in order to build theory around them.

Glaser (1978), Strauss (1987) and Charmaz (2006), recommend coding line by line because it forces the author to gain intimacy and familiarity with the data. Moreover, it is easier to defend because the author is an expert in the information. However, line by line coding is not always necessary. Glaser (1992) explains that there are certain circumstances where it may not be appropriate.

The open codes that were generated in main analysis for this project are listed in Figure 5 below. As mentioned previously, the open codes were derived from interviews with TTO staff members from each HEI (Higher Education Institute) in Scotland. Therefore, open codes were given as a generalization in order to become intimate and familiar with the data, which is recommended by Glaser (1978), Strauss (1987) and Charmaz (2006). The open codes were based on the data provided by the respondents which can be seen in the figure below and circled in red. The open codes/main themes include: "commercialization", "interaction between academics and industry", "job roles and responsibilities", "measuring impact", "number of employees", "number of years worked", "trust", "what they (TTOs, academics or industry partners) should or should not be doing". These open codes which are highlighted in the red circle are generated from responses from questions generated in the green square.

The term sources in the figure below represent the number of interview participants for the research project of which there were 16 in total. The term references alludes to the number of times a response from the interviewee would fit into the open code. For example, the open code commercialization was referenced by 12 interview respondents a total of 81 times.

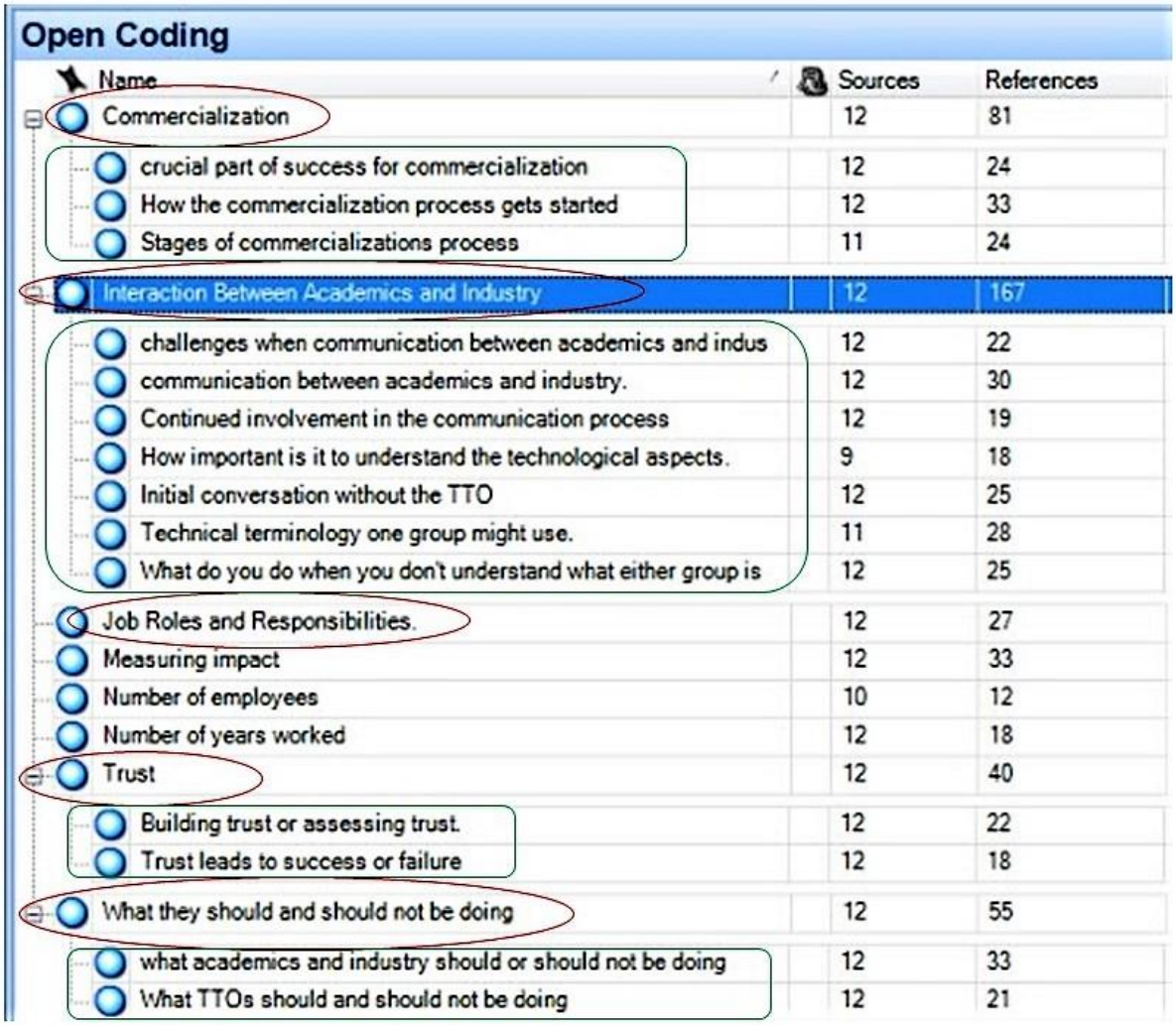

Figure 6: Open Codes

Source: Own material

3.20.4 Selective Coding

Selective coding is where the two different versions of grounded theory method diverge. The Straussian version requires axial coding to be done first. Strauss and Corbin (1998: 124) define axial coding as "the act of relating categories to subcategories along the lines of their properties and dimensions." The coding outlined by Strauss and Corbin (1990) contains cause conditions, context, intervening conditions, action/interactions strategies and consequences. This is somewhat similar to Glaser's version of selective coding but differs in the sense that Glaser (1978) defines selective coding as the stage when coding is limited to only those categories that relate to the core category. Furthermore, theoretical sampling is also directed by that core category meaning that the second phase of coding is based on the first or initial phase of coding. Additionally, Charmaz (2006) argues that the selective coding stage, which she also calls focused coding, may often result in the researcher returning to open coding because some

interesting information is almost guaranteed to occur when the researcher groups the themes emerging from the data.

The selective codes used in this project are listed in Figure 6. Selective codes were given to various responses from the participants, which are more specific. The following selective codes are related and further developed by the open codes which are described as interesting information and groups relating back to the core categories Charmaz (2006) and Glaser (1978). From the open codes commercialization, interaction between academics and industry, and job roles and responsibilities, specific patterns and themes began to emerge. Job roles and responsibilities help to explain who the TTOs work with and how they develop relationships. Furthermore, interaction between academics and industry helped to explain how TTO staff members develop relationships as well as how multiple groups of people communicate with one another. Lastly, commercialization helps to explain whether or not academic staff members at the various universities have awareness of the TTOs' services, coupled with communication between the TTO employees and academics. The information stated above helped to develop the following selective codes which are circled in red: "Who the TTOs work with", "Awareness of the TTO Services", "Relationships" and "Communication". In addition, selective codes pertaining to "Who the TTO works with" and "Awareness of the TTOs services" further helped the contextual knowledge surrounding the TTO, which will be discussed later in this chapter.

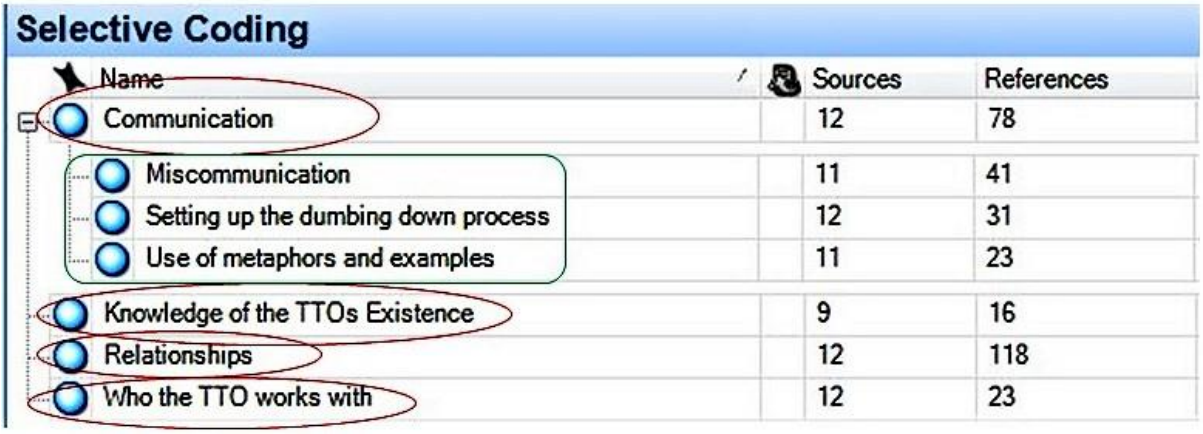

Figure 7: Selective Codes

Source: Own Material

3.20.5 Theoretical Coding

Theoretical coding is the third and final stage of coding for the Glaserian version of the grounded theory method. Glaser (1978) defines theoretical coding as the stage where codes generated from the data are related to each other. Therefore, theories are based on constructions and relationships. Theoretical coding is when the researcher

relates the codes to one another and looks at the nature of the relationships between those codes. Additionally, it is important to note that theory is not simply describing some interesting data analysis but, rather, it builds a theory based on those constructs and how they work together. For example, Charmaz (2006) argues theoretical codes do not impose frameworks on the data and remain objective around those codes as other scholars would almost inevitably disagree about the nature of those codes.

Theoretical coding, as mentioned previously, is when codes are related to one another. As Urquhart (2013) explains, this is the stage when theory starts to be filled out, given that theory is comprised of constructs and relationships. Glaser (1978) explains that theoretical coding establishes new connections that make ideas relevant that are often new and original. Urquhart (2013) further argues that if researchers do not relate the categories to one another there is no theory. Furthermore, there are possible sources of connections between these categories. The first involves other categories, which can often represent relationships. In the selective coding stage, by examining categories, it can sometimes be obvious that a category stands as a relationship between two other categories. Then the researcher would need to make sure that this relationship is supported by many different occurrences located within the data and further examine those examples to further define the relationship (Urquhart, 2013).

The second source of connection is derived from ideas about relationships from the literature. This is exemplified in Spradley's (1979) book The Ethnographic Interview. Furthermore, Glaser (1978) describes the concept of theoretical sensitivity meaning that researchers are sensitive to theories and have conducted a considerable amount of research through reading. Undertaking extensive reading, often outside of the researchers' general knowledge, helps them to understand how theorizing works and gives the researcher the chance to think differently about the relationships in their data.

The third source of connections comes from theoretical codes, which is introduced by Glaser (1978). Furthermore, the theoretical codes are useful when thinking about relationships between categories or how they relate to one another. Additionally, Glaser (2005) argues that it is better to have no theoretical code than to force one. It has to fit the data and assist in building the theory. Glaser (2005) further argues that the goal of the grounded theory method is to allow the researcher to develop as many theoretical codes as possible.

The theoretical codes used in this are listed in Figures 7 below are circled in red. The theoretical codes are based on and build off several selective codes which have been mentioned the previous paragraph. The selective code "Communication" is the basis for

the theoretical code “Dumbing Down”, a theoretical contribution which is defined as a way to communicate complicated discourse or information in such a way that it is easier to understand. Additionally, the selective codes “communication” and “relationships” help to develop the rest of the theoretical codes by illustrating where communication can become problematic during the commercialization process. The remaining theoretical codes are “face-to-face conversation”, “managing expectations”, “time scales”, “trust” and “understanding the technology.”

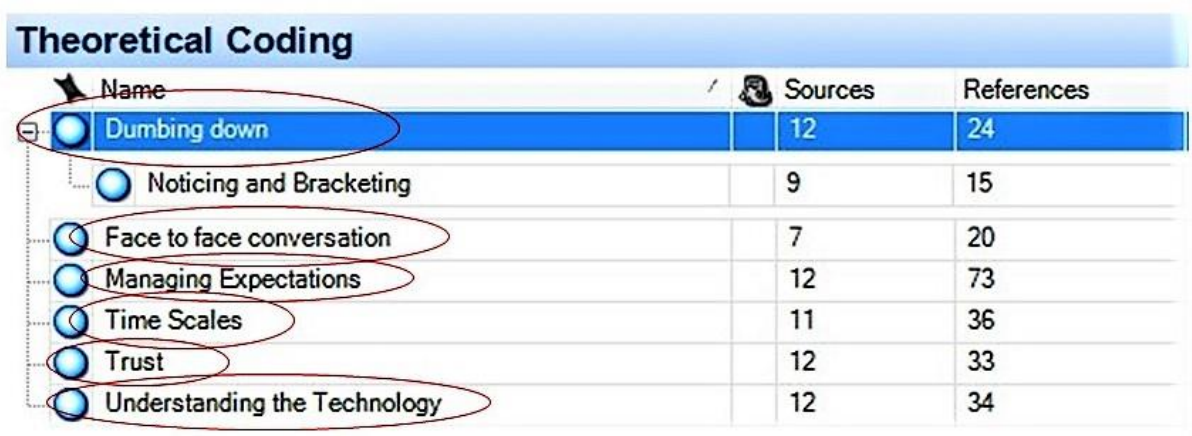

Figure 8: Theoretical Codes

Source: Own Material

3.20.6 NVivo Software

There are several different software programs that can be used in order to help with qualitative data analysis. These programs are sometimes referred to as QDA (Qualitative Data Analysis) software. Since the introduction of software programs to qualitative researchers there have been mixed feelings amongst the academic community. Some believe it can enhance their research while others feel it can distort the data. As Friese (2011: 2) explains, there are two schools of thought pertaining to QDA “those who see software as central to their way of analysing data and those who feel that it is peripheral and fear that using it leads to a wrong way of analysing data.”

QDA software does not write the researcher’s text; however, it does make it easier to write. QDA supports qualitative research but it does not automate or perform it. It remains the responsibility of the researcher to write the data as it is they who will be providing the codes and using the software (Flick, 2014). Furthermore, Flick (2014) argues there are different ways of utilizing QDA software and computers in qualitative research, but the main areas pertain to:

i. Data collection and fieldwork;

ii. Processing of collected data;
iii. Finalizing and presentation of the analysis;
iv. Project management;
v. Studying online phenomena.

Additionally, the literature makes several different assertions pertaining to the potential advantages of using QDA software. As Weitzman (2000) explains, the software increases the speed in handling, managing, searching and displaying the data along with linking related items to codes. The second assertion is that QDA software will increase the quality of the research or at least make the quality easier to show. For example, Kelle and Laurie (1995) and Welsh (2002) argue that the use of QDA software increases the validity of analyses in qualitative research.

For the purposes of this thesis, NVivo software was used in order to process the collection of data. According to Flick (2014: 463) software allows the researcher to:
Code (attaching keywords or tags to segments of text to permit later retrieval); storage (keeping text in an organized database); archiving, storying, search and retrieval (locating relevant segments of text and making them available for inspection); data linking (connecting relevant data segments to each other); forming categories (clusters or networks of information); memo writing (writing reflective commentaries on some aspect of the data, as a basis for deeper analysis); and content analysis (counting frequencies, sequence or locations of words and phrases).

Additionally, NVivo was used for finalizing and presenting the analysis. Which according to Flick (2014: 463) allows the scholar to:

> Data display (placing selected or reduced data in a condensed, organized format, such as a matrix or network, for inspection); the drawing of conclusions and their verification - aiding the analysts to interpret displayed data and to test or confirm the findings; theory building (developing systemic, conceptually coherent explanations of findings and testing hypotheses); graphic mapping (creating diagrams that depict the findings or theories); report writing (either interim or final reports).

3.21 Limitations and Biases

There are several limitations for this thesis. However, many of these limitations could be seen as possible strengths for this process. First and foremost, the researcher will have to limit his own personal bias and remain as objective as possible. Since, the pilot study was conducted at a university TTO ethnographically for several weeks there is a possibility the researcher might be drawn into the view of the world constructed by those individuals studied, therefore, potentially affecting interviews with other participants and the analysis of the data. Because of these factors, there is a possibility the researcher might lose analytical detachment (Deacon et al, 2007).

Secondly, even though the interview process has representatives from a majority of the universities in Scotland, there is a danger of only representing these specific universities and not the technology transfer industry as a whole. This issue is further intensified by the fact that the community of technology transfer (e.g., number of employees as well as number of universities) is very small in Scotland. There is a distinct possibility the researcher might miss something vitally important that contributes to the success or lack thereof to the organization.

Thirdly, many of the details gathered in this process may be considered sensitive in nature, not only to the organization but to the individuals who work there. The topic of research is a sensitive one and presenting it to the respondents may not be easy because we are discussing delicate information. The researcher must decide whether the topic of observation and interview should be described in detail. If so, there is the further problem of just how the research is to be described. Defining the boundaries of the research topic too tightly may inhibit respondents from defining the topics in their own way. In addition, defining the research objective one way may preclude the raising of other topics. Once having obtained the respondents' trust, it may still be difficult to inquire into aspects of their lives that may or may not be related to the topic at hand (Lee, 1993).

Because of the dynamic nature of the respondent relationship, there is a need to constantly interpret and evaluate the meaning of the observed situations and interview responses. In addition, there is a need to translate any industry specific terminology that may not make sense to anyone who works outside of the technology transfer industry. The words people use do not always express what their real feelings are and in trying to respond to difficult questions many people experience problems in finding precise words to explain what they are feeling or thinking. Even though the participants are industry professionals, they still might fumble for words, mumble, speak too fast or too slow, take long pauses, resort to catch phrases, and repeat themselves (Keats, 2000). These are all

issues that need to be considered during this process. In addition to interpreting what the respondents have conveyed, any form of bias needs to be identified that may have been presented by the participants. Bias could occur in the interpretation of the ethnographic study as well as in the answers to the interviews. “It can be conscious prejudice, or an underlying attitude so ingrained as to be a part of the whole way of thinking” (Keats, 2000: 61).

3.22 Validity

The concept of validity can be described in several different ways in qualitative studies. For example, Noble and Smith (2015; 34) state that validity “is the precision in which the findings accurately reflect the data.” Furthermore, Winter (2000: 1) argues that the concept of validity is not a single concept, nor is it fixed or a universal concept, but “rather a contingent construct, inescapably grounded in the process and intentions of a particular research methodologies and projects. In addition, Creswell and Miller (2000) suggest that validity is directly affected by the researcher perception and that perception is directly linked to the researcher’s paradigm. This is why Davies and Dodd (2002), Lincoln and Guba (1985), Seale (1999) and Stenbacka (2001) have argued that researchers will have different perception of what is considered valid in their own research will therefore need to consider other more appropriate terms such as quality, rigor and trustworthiness. Therefore, both Rolfe (2006) and Sandelowski (1993) explain that for the early career researcher, demonstrating validity or rigor for qualitative research methods is difficult because there is no accepted agreement by more experience researchers about the standards by which new research should be judged.

This research can be seen as valid or trustworthy because of the sampling that was conducted from both the exploratory study and the main study. By using the exploratory study to narrow down the sample size it allowed for the identification of key experts in the field of both technology transfer and discourse amongst academics and industry partners. Ultimately, by interviewing a large sample size of 16 experts in this field within a specific geographical region allows for validity in the research. Furthermore, the study is valid because it represents the experiences of the employees of Scottish TTOs which is outline in both aims and objectives of the study (illustrated throughout the thesis) along with the research design earlier on in this chapter section 3.9 on page 68.

3.23 Reliability

The term reliability is a concept that is used for testing and evaluating research. For example, Noble and Smith (2015: 34) state that reliability is “the consistency of analytical procedures, including accounting for personal and research method biases that

may have influenced the findings." Stenbacka (2001:551) further states that purpose of reliability in a qualitative study is "generate understanding". Furthermore, Eisner (1991: 58) explains that reliability from a good qualitative study can explain how to "understanding a situation that would otherwise be enigmatic or confusing."

This study is reliable for number of reasons. First and foremost, the study has accounted for the personal biases of the researcher, along with the biases of the sample size. Secondly, the researcher has kept meticulous notes and the data that was generated from this project has been subject to three rounds of coding through Glaserian grounded theory methods. Lastly, the research was carefully analysed by two other researchers before submitting the data. Lastly, the research can be considered reliable as it is only trying to represent the experiences and feelings on the Scottish TTO employees not those of the academics or industry partners.

3.24 Reflexivity

Reflexivity is the ability of the researcher to understand themselves and their motives. Pillow (2003: 178) explains that "reflexivity requires the researcher to be critically conscious through personal accounting of how the researcher's self-location (across for example, gender, race, class, sexuality, ethnicity, nationality) position, and interests influence all stages of the research process. Furthermore, Callaway (1992: 33) states reflexivity then "becomes a continuing mode of self-analysis and political awareness." The overall goal of reflexivity and self-awareness is to produce research that questions its own merits, along with ability to look back on the knowledge production in the effort to create a better less distorted research account (Hertz, 1997). Therefore, reflexivity is viewed as an ongoing process that makes it possible to visualize the construction of knowledge in order to produce a more accurate analysis of the research (Pillow, 2003). Lastly, Davies (1999) explains that reflexivity is the process of examining one's self retrospectively and is a process of self-reference.

There are several areas in which the researcher of this project has had a chance to be reflexive and how that might shape their view of the data. The age of the researcher depending on the year of the project was in their late 20s to early 30s, male, highly formally educated, a different nationality than those who were interviewed and had some work experience outside of academia before conducting this project. All of these factors could potentially influence the way in which the researcher views the world and how the interviewees responded to the researcher's questions. Furthermore, the only experience the researcher had in technology transfer and commercialization was a three-week exploratory study at the beginning of this project. Someone who had spent considerable

time working in these related fields could have a completely different view of the phenomena that was viewed throughout this project. Additionally, the researcher of this study made reflexive notes during the field work which can be viewed in Appendix 1.

3.25 Conclusion

The main research aim is to explore the field of technology transfer and to examine the strategies used to communicate between TTOs (along with their staff members), academics, and industrial partners as they try to work together, along with understanding this commercialization process through the lens of sense-making theory. Furthermore, the thesis seeks to further enhance knowledge of the commercialization process by improving communication strategies for those individuals and groups involved. Additionally, the research methodology will help to explore the objectives of the thesis, which are as follows:

i. Examine TTO discourse to understand how conversation between academics and industry partners overcome problematic communication to arrive at collaborative relationships.
ii. Explore instances of noticing and bracketing during academic-industry interactions and build an explanation of the role of the mediator in this process.
iii. Identify specific contributions to sense-making theory which enrich the understanding of mediator roles.

An interpretive paradigm was used in order to facilitate an epistemological standpoint of the interpretivist and ontological view of constructivism. This thesis builds theory inductively which leads to the identification of gaps in the literature.

Following the philosophical standpoint which has been illustrated throughout this chapter, qualitative research was utilized in order to answer the research questions. An ethnographic pilot case study that lasted three weeks was conducted at a university. Both field notes and interviews were coded and interpreted in a thematic analysis of the data. The information that was gathered became the basis for the interviews, which proceeded for the remainder of the data collection.

The interview process, which lasted several months depending on participants scheduling, included 16 interviews from 13 universities in Scotland. The Glaserian version of the grounded theory method was used in order to analyse the data. Open, selective and thematic coding were all conducted using NVivo software throughout the process. The findings from both the pilot study and interviews will be examined in greater detail in the next chapter.

Chapter 4: Findings and Analysis

4.1 Introduction to Interview Findings

The findings and analysis chapter contribute knowledge to both context and theory and can be broken down into several sections. The first finding contributes to context and managerial practice and is in the form of who TTOs work with both internally within the university and externally outside the campus. By only providing generalizations as to whom technology transfer offices and their staff members work with hinders the overall growth and success of the university technology transfer industry. The second finding relating to context discusses the overall lack of awareness the participants felt from academics' and industry partners pertaining to the TTO employees job roles and responsibilities. The third finding in relation to the research context is how communication, or lack thereof, can become problematic in the technology transfer environment. The findings show that there is a debate amongst the respondents in this study as to whether or not communication between academics and industry is problematic.

Furthermore, the first finding that contributes to sense-making theory consists of extending the modes in which people can make sense of information. In this context of technology transfer one of the ways making sense of the unknown can be accomplished is through the dumbing down process. The dumbing down of discourse is defined as a process in which a third party or mediator (in this case the TTO employee) notices a state of confusion during the communication between an academic or industry partner during the commercialization of university IP. The second contribution to sensemaking theory is expressed by examining how making sense of discourse can help to develop a relationship amongst group members. The second theoretical finding helps extend the current definitions of discourse and how different domains in organizational discourse such as conversation and dialogue, narratives and stories, rhetoric and tropes can be used to make sense of information that is being communicated during the commercialization process and how that information can be allocated to other individuals.

Finding six develops a model based on an analysis of interviewees' responses. The model named the RRB Model highlights the areas in which potential problems in the communication process between academics and industry partners may arise. This section also furthers the contribution to sense-making by developing a comprehensive model that can be used in any industry to identify problematic areas of communication. Additionally, the RRB Model contributes to the context of technology transfer by illustrating the

relevant areas of problematic communication that is specific to the technology transfer industry. The model is based on four theoretical codes which are listed in the methodology chapter (see chapter 3 section 3.30.3). The basis for the RRB model criteria is to highlight the most likely places in which the dumbing down process will occur because of the high potential of miscommunication.

The fourth and final section of this chapter is the conclusion to the chapter which will summarize the findings and analysis and provide the basis for the next chapter, the discussion.

Finding 1: Who do TTOs work with?

There is a variety of different reasons for universities to develop technology transfer offices. This is because there are several different ways to commercialize intellectual property developed by the university. Working with such a multitude of people creates a large assortment of groups, individuals, government organizations, and companies which the TTOs work with. Roberts and Malone (see chapter 2 section 2.2) express that it is a necessity for universities to have a dedicated group of individuals who can assist in technology transfer and commercialization activities by providing research and development (R&D), by patenting and licencing inventions along with creating spinouts and start-up companies. Additionally, universities offer a foundation for technical expertise for both academic staff and their research students (see Siegel in chapter 2 section 2.2).

Furthermore, universities influence the innovation process in multiple ways by combining multiple groups to collaborate with one another. This is done by conducting scientific research that works in partnership with companies that lead to publications. Additionally, collaboration can be achieved by partaking in informal networking events, joint R&D projects among the university and businesses, research funding and contract research with other universities and organizations (see Rogers in chapter 2 section 2.2).

However, the literature pertaining to who technology transfer offices work with is rather vague and does not distinguish between who TTOs work with internally within the university and externally outside the university. As the literature does not illustrate specifically who TTOs work with there is less information about technology transfer in the smaller regions of the UK, particularly Scotland.

The interview findings have shown that technology transfer offices are responsible for all the commercialization aspects of the university. Hence, TTOs are responsible for understanding a wide variety of different discourses that are used by the multiple groups they communicate with because that is what the job entails. For example, throughout the interview process there was a general feeling that TTOs and their employees communicate with a much wider audience than literature would suggest. When asked, one of the respondents, P6 (2015. Pg. 6. Line 12-14), simply stated:

> *"It is what the job entails. You must go and talk to the funders, the academics, patent agents. Then find a company that is interested in licensing it (technology) and it is at that point where you start talking to everyone. Then there are the internal and external legal people as well."*

In addition, to understanding the multiple discourses used throughout the commercialization process, the findings specifically highlight the variety of different people, groups, organizations, companies and government funding bodies that Scottish TTOs work with both internally within the university and externally outside of the campus. This is why the open code of "Who TTOs work with" was given to further illustrate the gap between what the literature states and what the findings show. For example, P10 explains the multiple groups they work with on a regular basis both internally and externally. According to P10, this is who they spend their time communicating with internally:

> *"Internally we work with each of the academic schools within the university. We have relationships with (work with) individual academics, with the directors of research, with the heads of schools and school managers. We also work with the university secretary, with the deans of research. At our university we have two deans, one for research impact, and one for research enhancement. So, we work quite closely with them looking at particular initiatives, do research, which might be peer reviewed, it might be around impact case studies. We also work very closely with finance occasionally on a day-to-day basis. We cover many departments."*
>
> (P10, 2015. Pg. 3. Line 28-49)

The findings also show that externally, TTOs work with a large variety of different people. P10 explains:

"Externally, we work with funding bodies. We have relationships with the Chief Scientist Office of Scotland, other Scottish funders like Carnegie Trust, Glasgow and Edinburgh Societies or nationally with the Scottish Research Council and local councils as well. We also work with various health funders and charities that we can work together and cooperate. Also, businesses engage with us for a number of reasons where they may have student placements or sort of student experience or maybe the business wants to contract us to do a piece of work on a specific project. There is quite a large number of them different types of organizations that we would engage with externally too."

(P10, 2015. Pg. 4. Line 11-24)

The interviewees all shared similar responses as to whom their TTOs worked with. The only differences were based on whether or not the university specialized in a specific area. For example, P12 (2015. Pg. 3. Lines 21-22)

"we work with funding bodies that are specific to our university's areas of expertise like food and beverage along with physics."

However, the findings show that TTO staff members tend to separate the groups of people based on their location, meaning internally (people that work at the university) or externally people located outside of the university. The literature explains that TTOs focus their efforts in specific areas like licensing or patenting. However, the literature does not specifically say who they work with. The findings enhance the knowledge pertaining to practice by highlighting key groups, individuals, and organizations that TTOs work with.

4.2 Finding 2: Awareness of TTO services

As mentioned in Chapter 2 (section 2.4 to 2.6) TTOs have had a large impact on university commercialization in both the United States and United Kingdom. As demonstrated in chapter 2 (section 2.3) of the literature review the concept was to help universities commercialize their technology by issuing licenses and promoting spinout companies. The concept quickly spread throughout the rest of the world. Since its inception the Bayh-Dole Act has helped to increase the licensing of technology (see Mowery and Shane in chapter 2 section 2.4.1). By the year 2000, nearly every major university had a TTO located on their campus in the United States (see Colyvas et al. in chapter 2 section 2.4.1). Additionally, by the year 2000 over 3,000 spinout companies had been created by the help of TTOs in the United States alone (see Pressman, 2000 in chapter 2 section 2.4.1). Furthermore, the university spinout generated billions in revenue,

created hundreds of thousands of jobs, and thousands of new companies have been created as a result of universities utilizing and developing TTOs (see Baycan and Stough, chapter 2 section 2.4.1)

In addition to the United States, who created government legislation in order to help foster the growth of university IP, the United Kingdom has also developed legislation to facilitate technology transfer. In recent years it has been focus of many government policies to help universities commercialize their IP. Additionally, Lambert (2003); Sainsbury (2007); and Wright et al. (2004) in chapter 2 sections 2.5 argue that these initiatives, developed by the UK government, have helped change the university culture throughout the UK. This means there is now a greater acceptance of entrepreneurship in academic communities. These policies that were created by the government have a significant impact on Scotland, which is the highest percentage of GDP (pertaining to university commercialization) when compared to the other UK Regions (for more comparative information see chapter 2 sections 2.5 and 2.6).

There has been overwhelming documentation concerning the TTOs' successful ability to help facilitate the creation of jobs, businesses, commercialize intellectual property by creating spinout companies and issuing licenses and patents. Additionally, academic research (illustrated in chapter 2 section 2.4 to 2.6) shows not only the United States and the United Kingdom's ability to make changes in government regulations but many other countries throughout the world as well. However, there is little evidence to support that, even though there is a plethora of documented data pertaining to the successes of the technology transfer industry, it has any influence on whether businesses or academics have awareness of the TTOs services or that they even exist. Therefore, the findings highlight that there is only a small percentage of individuals who have an awareness of the TTOs' services concerning how the offices commercialize IP.

After conducting the exploratory study and the interview portion of the thesis, one of the main themes that became apparent was there is very little evidence to support that many academics and business actually know what a TTO does. There seems to be very little knowledge about the day-to-day operations and how TTOs and their staff members can help commercialize the IP created by both business and academics. Additionally, there seems to be a lack of understanding on how TTOs and their employees can help academics with funding applications and protect themselves when they work with various companies. However, the academic literature (illustrated in chapter 2 sections 2.4 to 2.6) suggests there is a vast knowledge about the awareness of TTO services, how they work, and how they can help academics and businesses. For the reasons listed above, the

selective code "awareness of the TTOs services" has been given and the findings will add to a gap in contextual knowledge.

The opinions that have been illustrated above are best shown by the response of P10 who explains that there is still a big misunderstanding of what the TTO's function is:

> *"I would say barely, yes. There is certainly a big misunderstanding of what we do. I think there's some [academics] are very unsure, so I think there's still quite a job to do to really get them to understand what our role is."*
>
> (P10, 2015. Pg.17 Lines 57-58)

Furthermore, P3 explains more academics and businesses should know the purpose of their office and the resources they have in order to help academics and businesses collaborate. Additionally, P3 explains the great lengths to which their TTO goes to makes its presence known not only at their university but to the external community as well. P3 explains:

> *"Not as many as should (talking about the lack of knowledge on behalf of the academics and the industry partners). New academics coming into the system may or may not be up to speed in conducting these types of consultation or collaboration projects. Part of our function is to go to the individual schools at the university. We go to the researching enterprise meetings that are held by the schools. We make our presence known throughout the university. We have and send out internal communications to tell them (academics) what we do and refer them to our website. We invite academics and business to events to try and get them to communicate. We do as much internal selling to academics in the university, as we do externally to the surrounding areas."*
>
> (P3, 2015. Pg. 12. Lines 40-43.)

Furthermore, P7 expressed similar sentiments at their university especially towards the importance of advertising to internal staff and academics. They explain that internal advertising is an important way to develop the relationship with the academic. In P7's own words the academics at their university are described as "internal clients" because developing that relationship, trust and communication is not only important with the business but is equally as important with the academic:

> *"We do go to quite great lengths to engage with people (academics) to give the opportunity to engage (with businesses) we have sort of drop in*

sessions. We offer information sharing sessions with schools or faculties to let them know what it is we do and let them ask questions. And at the end of the day, a lot of this is about actually having worked with people. So, once we have worked with our internal clients, it becomes a lot easier."

(P7, 2015. Pgs. 11-12. Lines 48-5.)

However, there are exceptions to these feelings uttered by the TTO workers. There are a small number of academics' comparative to the amount of academics that are employed by the university that TTOs and their staff members work with on a regular basis. There are members of the academic staff who want to engage with industry and others that consider themselves to be entrepreneurs. All of the TTO employees stated that academics who regularly try to work in collaborations with businesses or publish research and look for funding opportunities from outside organizations have a very good knowledge of what the TTO does. For example, P9 says:

"Those that want to engage, know (what the TTO does). Those that don't want to engage probably not."

(P9, 2015. Pg. 9. Lines 14-15)

Overall, the responses from the various interviewees were not that positive towards their academic staff counterparts. Where the TTO employees seemed to be optimistic was the number of people they are working with was starting to slowly increase. However, the number of people is still not as high as they would like. The reasons for the slow increase in awareness, though, include a variety of different aspects, mostly initiatives developed by the UK government (REF) and by the universities who want to gather more funding from the government. Also, there seems to be a growing trend on behalf of the academic staff members who want to conduct industry relevant research. According to P4,

"I would say increasingly knowledge of what we do. This is in part due to the fact many academics (at this university) now want to conduct research, teach and participate in knowledge exchange, which covers commercialization in order to remain relevant. But to be blunt about it, there are many academics that are not really engaged in knowledge exchange anyway. They are not interested. They [academics] like to sit on

the side-lines, and those are the ones that have no idea what our office does."

(P4, 2015. Pg. 7. Lines 9-11)

4.3 Finding 3: Discourse

The next section of the findings addresses the issues pertaining to discourse. Discourse between academics and industry can be lost in translation (see Graham et al, 2006, Shapiro et al, 2007, Fincham and Clark, 2009 in chapter 2 section 2.8). This is why so many business schools' scholars study knowledge management and how to communicate it between researchers and practitioners (see Fincham and Clark in chapter 2 section 2.8). Other researchers suggest that discourse is intended for a specific audience; therefore, it can either become lost in translation or lost before translation. Additionally, not only does the problem come from having different discourses but also different styles and ways of communicating within a specific scientific community (see Shapiro et al., 2007, Kiser and Leiner, 2009 in chapter 2 section 2.10.1). This is why having a highly specialized group such as a TTO and their employees that can help develop partnerships between academics and industry is important. Additionally, TTO workers can aid in the communication process, which is needed to support training and theory with research methods. Thus, bridging this gap in discourse can lead to high quality collaboration between multiple groups of people.

Discourse between academics and industry argues that the communication between them is problematic for a variety of different reasons (as mentioned above and in chapter 2 section 2.10.1). However, the findings show that there is some debate in the technology transfer community concerning problematic discourse. Some of the interviewees expressed there were no problems in communicating different discourses between academics and industry partners while others suggested that problematic discourse is a regular occurrence. For the purpose of this study's findings and analysis the selective code of communication was given as a blanket term to encompass all aspects of discourse, which include verbal, non-verbal, dialogue, narratives, stories and metaphors. This was done in order to make sure every potential aspect of discourse was covered and since TTO employees used the phrase of communication rather than discourse.

All the respondents in the interviews agreed that communication (understanding discourse) is a vital part of the commercialization process, which is why the selective code "Communication" was applied in order to illustrate the importance of properly

communicating different discourses between academics and industry partners. However, the findings show there is some disagreement between whether or not understanding various discourses is a problem. In other words, do academics and industry have a problem communicating with one another? About half of the respondents in the interviews expressed that there is not a problem with communication. These respondents believe that it is a very straightforward process and those academics who engage with industry on a regular basis tend not to have any issues with communication. Furthermore, some of the respondents added that some academics will change their discourse in order to better suit industry. For example, P1 explains that:

> *"I do not have any problems pertaining to the interaction between university and academics, once we start talking to industry we usually have a good outcome. Scientists are scientists, they know the terminology regardless, of whether they are a scientist in industry or academia. We would not be talking to people who did not know what they were talking about. In addition, we would not be talking to people who did not understand what the science was about."*
>
> (P1, 2015. Pg. 4. Lines 23-32)

In addition, P4 adds:

> *"Communication between academics and industry is really a nonissue. Both academics working in a specific field and industrialists will use the same discourse."*
>
> (2014. Pg. 7. Line 33-34)

Moreover, P6 explains that:

> *"Most of the academics you want to collaborate with in this industry will attempt to make sure that they are not using jargon-filled discourse. When the academics themselves make an effort to ensure they are communicating in a way that the other side will understand, you will not have any issues."*
>
> (P6, 2015. Pg. 13. Lines 18-20)

However, the other respondents' opinions on whether understanding discourse is an issue between the multiple groups involved in the commercialization process are the exact opposite of their colleagues. Many TTO employees feel that the communication process is not a clear one and misunderstanding of discourses between the groups occurs on a regular basis and is ultimately part of the commercialization process. The respondents share that there generally seems to be a lack of understanding concerning the stance of the other person. For example, P11 says:

> *"Communication between academics and industry is quite challenging and it is adapting your (the TTO staff members) own style to converse intelligently with both of them. It is difficult. It comes down to the understanding. Both academics and industry have to understand that the person they are talking to…especially businesses, have a tendency to talk about growth structures, turnovers and very specific terms that belong within their processing line which, many of the academics will not have any experience with because they have never worked within a business. Academics are very clued up to academic funding but maybe not other things and other discourses. Work on projects with different groups can be very confusing to people. There is different terminology that gets used and we (TTOs employees) need to understand what that terminology means."*
>
> (P11, 2015. Pg. 4. Lines 21-25)

There are other reasons why understanding discourses between academics and business can become complicated. P11 further argues that many academics have difficulty speaking in simplistic terms, which can leave others in the conversation to speculate what the academic is attempting to say. P11 states:

> *"It is mostly a lack of understanding between academics and industry. Academics often find it difficult to talk in non-professionals' language because they have a scientific term, which can say so much more than 100 words can say. They often do not understand that I am (the TTO employee) trying to explain that in an understandable way to a businessperson which can be very difficult."*
>
> (P11, 2015. Pg. 4. Line 16-19)

Additionally, academics often do not realize that the person they are speaking to in a meeting is not the person that is going to be funding the project. Sometimes the overall hierarchy of business and organizations confuses the academic. Furthermore, many TTO staff members take an active approach in communicating between the groups involved in commercialization. However, TTO employees tend to understand the basics and are not experts in the field. For example, P6 explains:

> *"I think academics often do not understand that the person in industry that they are talking to is not the decision-maker when it comes to committing funding to a project. I think it is unfortunate that we (TTO employees) understand the basics, but I do not think we have to have the full picture of what the other partner is saying. Personally, I need to have it explained to me in very simple discourse."*
>
> (P6, 2015. Pg. 11. Lines 21-45)

4.4 Finding 4: The Dumbing Down Process

Initiating the Dumbing Down Process

As described in chapter two of the literature review Weick et. al. has defined the process of sense-making. They state that sense-making begins with a chaotic situation. Once actors in the situation begin to perceive that communication is not flowing smoothly, the next part of the process is noticing and bracketing. Magala (1997: 324) specifically states noticing and bracketing means: "inventing a new meaning (interpretation) for something that is already occurring during the organizing process, but does not have a name, has never been recognized as a separate autonomous process, object, event." Noticing and bracketing is based on previous experience that has been developed over time from other group members in the sense-making process (see Weick et al. 2005, chapter 2 section 2.11.4). However, little academic research has identified who is noticing and bracketing during the sense-making process. The findings identify the TTO staff members as the individual or group that notices a state of chaos or confusion amongst the other group members.

For example, some of the participants expressed that when they notice a state of confusion or flux, they will give both groups some time to see if they can come to a mutual understanding and try not to get involved. Thus, not stopping the sense-making process of what is being communicated. Other respondents mentioned they might ask a couple of questions to see if the discourse used by either group becomes clearer. Ultimately, it is up

to individual TTO staff members to try and read the situation, assess the discourse that is being used and find a way to make sure the communication between the groups is clear. For example, P10 shares:

> *"I might take a minute or two to try and see if it becomes clearer. Once the academic or business has expanded upon their particular point, and if it is not clearer, then I would ask them to clarify it."*
>
> (P10, 2015. Pg. 7. Lines 47-48)

Additionally, P7 states:

> *"I will ask both parties what is the problem we are trying to solve before we actually start throwing potential solutions at things."*
>
> (P7, 2015. Pg. 9. Line 40-45)

If the discourse does not become clearer either with time or by answering questions that are designed to clarify the information that is being communicated, then the TTO employee will often resort to dumbing the information down.

The Dumbing Down Process

The findings, however, illustrate that if the understanding of discourse during the communication process does not become clearer through further conversation there is a strategy that TTO employees can utilize in order to make sense. This technique was originally observed during the pilot study. A thematic code was given and called "Dumbing Down" because one of the participants in the exploratory study used the term "Dumbing Down" in order to illustrate how she came to a mutual understanding between academics and industry when their discourse had become problematic.

Dumbing Down is defined as a way to make complicated discourse or information easier to understand and usually happens when the TTO employee, academic and industry partner are having a conversation with one another. This process is carried out by a mediator and, for this thesis, it is a TTO staff member who stops the sense-making process or the conversation, because they notice a state of confusion or chaos from either the academic or the industry partner. This momentary break from the conversation allows other group members to pause and find a way to communicate information into simpler discourse, thus, dumbing down the discourse so that it can be understood and used by

other group members. Chia (2000) explains that when this happens the information becomes functionally deployable to other members. The TTO employee or mediator structures the conversation in such a way that they will not move forward in the commercialization process until everyone in the group has a mutual understanding of the discourse. Once a mutual understanding is agreed upon by the group members the sense-making process can continue, along with the commercialization of university intellectual property.

Sense-making theory is based on people's notions to try and make sense of events that have occurred. Additionally, this process is done in the past tense. For example, some researchers argue sense-making is our (a person's) effort to try and create meaning and understanding retrospectively from something that has previously happened. Furthermore, there are several ways to make sense of things we do not understand which include sensegiving, sense breaking, mediated sense-making, etc. (see Weick et al., 2005; Gioia and Chittipeddit, 1991; Pratt, 2000; Strike and Rerup 2016 in chapter 2 sections 2.11.10 and 2.11.11). The notion of sense-making has also led to the development of several other theories based around ways to make sense of things like the process of sensebreaking which is an action undertaken by the sensemaker to destruct or the breaking down of meaning (see Pratt, 2000 in chapter 2 section 2.11.10). Strike and Rerup, (2016) (chapter 2 section 2.11.11) have developed theories such as mediated sense-making, which is when an individual acts as a mediator, to help individuals in the conversation to think differently about the sense that has already been made.

The findings show that dumbing down of discourse is a form of communication that helps to make sense of information; this process differs from other versions of sense-making literature because sense has yet to be made. Even though the process of making sense is done retrospectively, the findings demonstrate how the dumbing down of information happens as the conversation between academics and industry is taking place. Thus, dumbing down is happening in real time rather than leaving the conversation for a length of time and then starting the process again. Additionally, the findings highlight the role of TTO staff members as mediators; this is an aspect in which little research has been applied. Although there is academic literature that focuses on the different modes of sense-making, very little research has focused on making sense by deliberately stopping the sense-making process especially when sense has yet to have been made, which is specifically illustrated by the dumbing down process. In Weick's view of sense-making the process of dumbing down would be illustrated as labelling and bracketing (see Weick

et al. 2005 in chapter 2 section 2.11.5). This is where and individual in the sense-making process tries to stabilize chaotic events and make sense of them. The act of labelling and bracketing is to identify and classify information in order for it to be useful to other group members (see Chia, 2000 chapter 2 section 2.11.5)

Many of the interviewees utilize this technique if the communication process has become problematic for the individuals involved in the commercialization process. The dumbing down process is taking discourse that is complicated or difficult to understand (due to a multitude of reasons, some of which will be discussed later in this chapter) and asking for the information to be communicated either by the academic or industry partner in the simplest terms possible. The findings show there several different ways in order to dumb down the information, this is usually done through phrases like "laymen's terms" or "I do not get it, can you please explain". Regardless of how the information is dumbed down, it is used as an effort to try to re-establish communication and maintain a level of understanding between members involved in the communication process. This is when the TTO employee needs the discourse to be simple and not be afraid to appear dumb or stupid in front of the other members in the group. For example, P5 states:

> *"I would ask an academic to break it down for me in order for me to understand, explain it in layman's terms. It is always as easy for me to ask a stupid question, or to try to rephrase it for what either the academic has said, or for that matter what the company has said, in words that I think the other members in the conversation will understand."*
>
> (P5, 2015. Pg. 11-12. Lines 45-12)

Furthermore, having the ability to read body language is an important aspect in dumbing down. For someone who is experienced in these types of commercialization projects it is rather easy to see when someone does not understand what is being communicated. Reading the body language of group members can allow the TTO worker to break down the information in a more simplistic manner. For example, P8 describes:

> *"You do have to step in occasionally when you see people talking to each other and it is very obvious from the body language the person does not understand the level of detail especially if an academic or business talks very technical you can see either the academics or industry partners roll their heads. Sometimes you have to pretend you are talking to a 12-year-*

old child. I do this by trying to bring it down to a base like understanding. Get the information dumbed down to simplistic terms so that anyone can understand what technology is, not necessarily the workings of the technology but the benefits. I will ask, 'What you're talking about here', 'would you mind dumbing it down a little bit.' I am not afraid to say, 'I do not understand this.'"

(P8, 2015. Pg. 11-12. Lines 11-15.)

In summary, the dumbing down process is based on the TTO staff member noticing a state of confusion or flux. Identifying such a state is usually based on the TTO workers pervious work experience or their ability to read another individual's body language. The TTO staff member acting as the mediator of the group asks for clarification to be made. Thus, by asking for clarification they are stopping the sense-making process. Questions will continue to be asked by either the TTO employee, the academic or the industry partner until sense has been made of the discourse and communication has been re-established.

4.5 Finding 5: Developing the Relationship

It has been argued by Weick (1995), who is considered the father of sense-making theory, the role of discourse in sense-making can lead to understanding and can help produce clarification (see Cornelissen et al, 2011; Fenton and Langley, 2011 in chapter 2 section 2.22.2). However, very little attention has been paid to the role that making sense of discourse can help develop the relationship between multiple groups of people; specifically, in this context between academics and industry partners. The findings show that the TTO staff members' ability to dumb down and disrupt the sense making process during communication of different discourses will not only help the individuals in the commercialization process make sense of the discourse but can also help to develop a relationship between these individuals.

One of the main threads that became apparent while interviewing the participants was the need for "developing the relationship." This categorization is developed from the selective code "relationships" and is routed in several other selective codes that explain the criteria needed to develop relationships. This will be examined further in the next section of the findings. All of the respondents agreed that developing the relationship is a critical part of the commercialization process. If the relationship between the academic and the industry partner does not develop properly, there is very little chance of

commercializing the IP. The interviewees describe (and are also selective codes) why the relationship is important, the time it takes to develop the relationship and that the relationship is based on discourse and understanding. The following sections also highlight how fragile the relationships between academics and industry really are thus illustrating the delicate balancing act or moderator role that a TTO employee plays between these groups of people.

Why is the relationship important?

Developing the right relationship or the right fit between the academic and industry partner is a crucial step for those involved in the commercialization process. It is like a sports team; everyone needs to be able to work together and trust each other in order to be successful. As all of the respondents have hinted throughout the interview process, if it is not the right relationship between the two groups of people, the project can fail before it even begins. Furthermore, all of the respondents described a delicate relationship between academics and industry because they come from two separate fields of thought. This relationship therefore needs to be based on trust which, as P11 describes, comes from a mutual understanding of one another:

> *"Businesses cannot understand why the academics do not understand their business discourse and why certain things are important to them. There needs to be a little bit more of a marriage between understanding each other's viewpoints. That is the biggest challenge. Getting them to see it from each other's side."*
>
> (P11, 2015. Pg. 4. Line 21-25)

In addition, it has been expressed by several of the participants in this study that if academics and industry partners can understand the wants and needs of the other party involved in the commercialization process communication is more likely to be effective. Hence, why the dumbing down of information is a vital strategy used by TTO employees.

Many universities have a similar strategy in establishing a trusting relationship between academics and industry partners. Sometimes, especially with a newer or younger academic they might start the relationship with a very small project. This same logic also applies to a business which has never worked with academics before. There is also a long-term thinking for many of the TTOs and their staff members. A one-off project is helpful but if the TTO employees can develop a long-term relationship it can become mutually beneficial and offer a constant stream of revenue for the university. As P11 explains:

"Start off with a small project it is a good way for somebody who has never been involved with a project before to build a little trust. Then hopefully move on to a bigger funding project and develop a strategic partnership with them."

(P11, 2015. Pg. 7. Lines 27-30)

Every participant in this study has agreed that trust is a critical factor in developing the relationship. As they have summarized, trust is everything and without it the project cannot move in a positive direction. Several of the respondents shared that trust is inherently part of the commercialization process, which is why the issue of trust was not examined further. For example, P5 shares:

"I just automatically trust them (either the academic or the business) and I think that goes for the other individuals as well unless given a reason not to".

(P5, 2015. Pg. 14. Line 33.)

However, it seems that even the smallest of things can lead to people in these projects not trusting one another which, based on the interview responses, is also a common problem. As P6 explains:

"If you lose trust, you have lost everything. It is a problem with both the academic and the industry partner. There are many things that one can do to lose trust. Even not responding to emails for a certain amount of time can mean that a relationship is not going anywhere…Because it happens all the time."

(P6, 2015. Pg. 17-18. Lines 47-26.)

Additionally, once the relationship has been broken it is nearly impossible to repair because it is about building that trust with people. A company may come back to work with the university again but not a specific individual and vice versa. As P8 explains, although unlikely, they have experienced this scenario a couple of different times:

"Once the trust is completely gone, that is it, forget it. It is not to say that you would not have a project with the same company and the university with another member of academic staff and vice versa. I have seen that scenario a few times, but once the trust is broken down with an individual from a university, it is very hard to repair that relationship."

(P8, 2015. Pg. 14. Line 11-14.)

Discourse and Understanding

Every one of the respondents in the interview agreed that trust is a key component to developing the relationship and why it is important. But how does a TTO and their workers develop this relationship and what is it based upon? After analysing the interviews, it became clear that this is based on discourse and understanding. These two factors are the keys for building a relationship in the fast-paced environment of technology transfer. Without proper communication and mutual understanding of the discourse that is being communicated by everyone involved in the commercialization process the project is unlikely to be successful. The discourse and understanding comes from realistic expectations on what all parties involved in the project are required to complete. As P2 expressed:

> *"Make sure everyone's expectations are on the table [meaning known to each other] and realistic. Both sides need to [fully] commit to the relationship. Recommendations [made by either the academic or industry] are how you build strong, trusting, purposeful relationships that have a clear vision and clear expectations. It is a recognition of these aspects that develop good commercialization, which arises from good relationships."*
>
> (P2, 2015. Pgs. 7 and 8. Lines 24-3.)

Another respondent also makes a note that it is much easier for an academic who has worked in industry before to understand the wants and needs of the business. Additionally, academics who consult with businesses on a regular basis would also have an easier time understanding the discourse communicated by industry. As P8 explains:

> *"If you have academic staff who are very used to working with industry, then it is an easy process. They understand the business language [discourse]. We have quite a lot of academic staff who have already worked in industry. They understand the language. They understand the process. They understand the time skills and time pressures of business."*
>
> (P8, 2015. Pg. 8. Lines 25-35.)

How long does it take to develop the relationship?

This portion of the findings is where the answers from the participants vary drastically. There seems to be two different opinions as to the amount of time it takes to

develop the relationship. One view is that the connection needs to be instantaneous. If the connection is not made almost immediately then the relationship will not work. For this group of people, the general thought is the quicker the better, that way nobody's time is wasted. Companies want to speak to the expert as soon as possible to see if they can help that company fix a problem. For example, P1 states:

> *"If there is not trust [relationship] straight from the start, then it won't work."*
>
> (P1, 2015. Pg. 7. Line 26.)

In addition, P9 shares:

> *"To be honest, in my experience, if they do not hit it off quickly, I will be very reluctant [to have the project move forward]."*
>
> (P6, 2015. Pg. 6. Line 22.)

However, the other viewpoint expressed throughout the interviews was that developing the relationship takes some time and that everyone involved in the commercialization process needs to be patient. Some of the respondents explained that there needs to be chemistry between the academic and the business. Ultimately, this chemistry is what the TTO employees are looking for in order to move forward. For example, P4 states:

> *"For the most part it's great because you've made the introduction between the academic and the business and something clicks. However, sometimes it is necessary for it to take time to build up the trust and build the relationship"*
>
> (P4, 2015. Pg. 17. Line 10.)

Additionally, P8 explains:

> *"From a company's point of view, they generally have to dip their toe in the water on some occasions. That is why we do a small piece of work like a student project or something that builds up the companies' confidence that the academic is going to deliver. Generally, the company has to build up a relationship over a period of time with a university and get confidence that the university's going to deliver. If you cannot engage in a small piece*

of work and you do not deliver, then there is very little chance of further working with that company."

(P8, 2015. Pgs. 12-13. Lines 48-16.)

Even though there is some debate towards the amount of time needed in order to develop the relationship between the academic and industry partner, what is agreed upon is the need for chemistry between the two. The TTO and their employees need to develop the right relationship in order to move forward with the commercialization project.

4.6 Finding 6: Criteria for Relationship Building (RRB Model)

The criteria for relationship building contributes to knowledge in two separate ways. It furthers the information that was developed in the previous section concerning developing the relationship, which contributes to both sense-making and discourse. Additionally, the model helps by providing contextual knowledge to the TTO office as well as their staff members as it points out specific qualifications where understanding of different discourses between academics and industry can become problematic. The model is routed in the interviewees' responses towards developing relationships. Four thematic codes were given based on these responses. They are Face-to-Face Communication, Managing Expectations, Meeting the Time Scales and Understanding the Technology. If discourse between academics and industry becomes problematic based on the interviewees' responses, it is usually in one of these four criteria. There are numerous accounts of the role that dialogue plays in the development of interpersonal relationships (see Ballantyne 2004 paper "Dialogue and its role in the development of relationship specific knowledge") However, as mentioned previously there is very little knowledge as to how making sense of discourse can help to build a relationship. Therefore, the goal of this model is to extend the knowledge of relationship building by illustrating where the dialogue can become problematic within the context of technology transfer. Additionally, the model helps to show where the dumbing down process will generally take place in one of the four areas.

Face-to-Face Communication

The first criterion is face-to-face communication when two or more people are placed within a specific area or setting and have a conversation with each other. Some of the respondents have shared that the reason why it is important for people to meet in person is so they can read the group members' body language, and identify and address

any confusion; it also helps to develop the relationship by physically seeing people. For the purposes of these findings, face-to-face communication does not include Skype or video-telecommunication because the interviewees explained this is not the same as being in the same room with someone. Even though the people's faces can be seen through video conferencing it is not an acceptable substitute because it remains difficult to gauge someone's response to the discourse that is being communicated. However, sometimes face-to-face meetings are impossible because of geographical location and video conference in this case is used; nevertheless, according to many of respondents, it is not a substitute for being in the presence of another person. For example, P8 explains, that:

> *"I prefer face-to-face, because you can gauge people's reaction. If you have conference calls specifically just on the telephone, you can't see people's faces."*
>
> (P8, 2015. Pg. 7. Lines 32-44.)

Furthermore, P3 expresses:

> *"I think face-to-face meetings are fundamental, especially in those initial discussions. What is happening in early meetings both academics and businesses are weighing each other up from a technical and competency point of view, but also they are gauging whether or not they can trust one another. They are asking questions like 'Do we like this individual? Do we like this organization?'"*
>
> (P3, 2015. Pg. 12. Lines 18-30.)

Managing Expectations

The second criterion needed to build a relationship involves managing expectations. This is what is expected from either the TTO staff member, the academic or the industry partner in terms of deliverables from the project. Essentially, what is this person expected to do and how they are expected to do it? If the TTO employee is able to manage both the academic and industry partner's expectations both individually and collectively as a group, the TTO worker can manage any issues that may arise later in the commercialization process. By declaring and managing the expectations early in the commercialization process, the TTO employee alleviates any miscommunication or misunderstanding by dumbing down the information, which can lead to confusion or

angst later in the project. Many of the interviewees expressed that managing expectations was the most difficult part of their job because of the different or unrealistic expectations that either a company or an academic might have. For example, P9 states:

> *"The biggest challenge is expectations and it can be really difficult".*
>
> (P9, 2015. Pg. 5. Line 22.)

Furthermore, P2 adds:

> *"One of the challenges is really to manage expectations on both sides. What can and cannot be done and what is a realistic offering, and what happens after the project is completed?"*
>
> (P2, 2015. Pg. 6. Lines 2-5.)

Lastly, P1 explains:

> *"There can be different expectations and different demands on academics than their counterpart in industry and so it has to be managed. The differences in expectations or perceptions occur but this is not a scientific expectation or a scientific understanding it is the expectation of what is supposed to be delivered."*
>
> (P1, 2015. Pg. 3. Lines 14-16.)

Meeting the Time Scales

The third criterion needed to build a relationship is meeting the time scales. Managing the time scales is another crucial part of building the relationship because if things tend to linger on for long periods either through unanswered emails, telephone calls or progress with the project, this can lead to mistrust towards the parties involved in the process. Additionally, this can be a potential problem for both the academic and the industry partner. The academic already has a full-time job which involves teaching, research, marking papers and administrative work and therefore needs to adjust to outside consulting work. Additionally, many businesses have specific deadlines and goals they are trying to meet, along with trying to make a profit. For example, P6 states:

> *"For industry wants to get this project done. And they need to get it done by the right person and as soon as possible. The academic says I find this*

project interesting. I could do it, but I cannot start the project until the end of October when all these students have disappeared. I have seen a number of attempts at collaboration being misaligned because of the expectations of time. I think that being straightforward about their responsibilities and not over promising what they can deliver. Making sure that it fits in with the academics and teaching schedules are key to a successful project."

(P6, 2015. Pg. 22. Lines 18-37.)

Additionally, P8 explains that:

"*Businesses have specific deadlines and targets. The main difference between industry and academia is time scales. Challenges are mainly what I have alluded [throughout the interview] to in terms of time scales, lack of understanding. Businesses are very focused on the bottom line. They want a project delivered. They want money. They want new products. They want new processes. It is all about how they are going to increase their turnover. How they are going to create jobs, etc."*

(P8, 2015. Pg. 8. Lines 25-46.)

Understanding the Technology

Understanding the technology, in terms of how it works and what problems the technology solves is the fourth and final step in developing a relationship between academics and industry. According to the interviewees, it is crucial that the academics and industry partners understand the technology. Even though it is not necessary for the TTO and their staff members to understand the technology in detail, analysis of the interviews shows that it does help if the TTO employee has an understanding. Many of the employees at the various TTOs have a high level of education and/or have had successful business backgrounds. However, it is vital to note that a TTO staff member's job is not to be considered as an expert in the field, their role is to facilitate commercialization, which is why many independently conduct their own research on a particular subject matter. Nevertheless, by having a basic understanding of the technology, TTO employees can help manage the communication between the academics and industry, along with providing an explanation if any miscommunications arise or noticing confusion on behalf of the other members involved allowing for the information

to be dumbed down. TTO staff members can gain knowledge of a particular technology in various ways. For example, P4 describes:

> *"I Google a lot. I would say I do a lot of background reading to make sure I do understand. I ask questions as well. When I was starting out in technology transfer, I felt like I had to know everything and that every meeting with a company is a potential pitch. However, you realize that if you listen to them [academics or industry], it can be a far more productive meeting if you ask questions. I have never met anyone who is put off by the fact that you are asking questions because it just shows you are interested and curious. It shows you do not have a problem with being the person in the room that asks what might seem like basic questions. I personally think it is very important."*

(P4, 2015. Pgs. 10-11. Lines 41-26.)

Additionally, P11 states:

> *"I will independently ask them [either the academic or industry partner] to explain it to me. Come back and show me and call after [a meeting] and explain to me. I do a lot of reading. I personally to understand. I will take stuff from their website [the companies or academics] and try to make it more understandable, I am always trying to make the information more understandable. For me personally it is important because I like to be able to understand because that is the way I work. I think it gives you credibility to what you are trying to do."*

(P11, 2015. Pgs. 5-6. Lines 35-15.)

Furthermore, P5 shares:

> *"I tend to not understand what the academics are saying but I do think it is reasonably important. You obviously want to know what you are talking about, and there is always questions that industry has about a particular project and therefore I need help from the academics. However, industry is happy with the fact I do not understand. No one expects you to know the kind of intricate detail about the projects."*

(P5, 2015. Pgs. 11-12. Lines 29-26.)

4.7 Conclusions

The findings have shown the results of a thematic analysis that was conducted after the exploratory study that highlighted the themes that would later be used as the foundation for the main interview process. The themes that were highlighted during the exploratory study were "Who the TTOs work with", "Awareness of the TTOs services" and "Communication between the university TTO and Academics/Industry partners". This led to the formation of several codes that were developed from the interview process, which emphasized who the TTOs work with, both internally and externally but also showed there is very little knowledge as to who the TTOs actually work with to commercialize IP. This was the first contribution to context. The findings have also shown in a second contribution to context that there seems to be very little awareness of the TTOs' services in both the academic and industry communities. Additionally, the third contribution to context places emphasis on a background problem pertaining to understanding different discourses between academics and industry, which could affect the potential outcome of a commercialization project.

Furthermore, the findings also contribute to theory by introducing the idea of mediated sense-making to the literature of sense-making. This is accomplished in a variety of different ways. Firstly, the dumbing down process highlights the ability to make sense of the unknown in an entirely new way. An analysis of the data gathered here suggests that sense-making can occur in a mediated fashion i.e. rather than in direct person to person or person to experience modes. In this research setting, sense-making occurs where a mediator (in this case the TTO) notices that someone (either the academic or industry partner) is confused. The idea of noticing is already established in the sense-making literature (see Weick et al. 2005, chapter 2 section 2.11.4) but here, noticing is done "on behalf of" another. Noticing here is based on reading the person's body language and/or previous experience. By labelling this as confusing, the TTO can then bracket the information. Bracketing again, is a concept already present in the sense-making literature but here it takes a particular form which is labelled "dumbing down". In enriching the extant sense-making literature therefore, this study shows that the making of sense is enabled in a tripartite relationship during the commercialization process through the actions of a mediator (the TTO). The findings also highlight the process of how to develop the relationship between academics and industry partners and why it is so important to do so. This also contributes to theory by showing the importance of developing a relationship and the role that it places in the sense-making process.

What is different between the findings illustrated in this chapter and those highlighted by sense-making theory is introducing the TTO employee as a mediator. In this particular case, the TTO employee is facilitating the sense making process and is the sensemaker, noticer, bracketer, labeller and categorizer. However, where these findings contribute to sense-making theory is by examining how the TTO employee deliberately stops the sense-making process in order to make sense of the discourse that is being communicated by the other groups involved. Additionally, the findings illustrate how someone who is not an expert in the field can add to the sense-making process even though they (the TTO employee) are not actually making sense, rather facilitating the understanding of discourse in such a way that sense can be made. Furthermore, the literature outlined by Weick assumes that the individual that is making the sense is the person who is noticing, bracketing, labelling and categorizing. In this particular set of circumstances this is not the case; rather, the individual who is recognizing there is a state of chaos directs the conversation in such a way for others to be able to understand information (as Chia explains functionally deployable).

Lastly, a model was developed called the RRB Model. The model was based on four thematic codes that were derived from the interview responses. The interviews expressed these four areas (face-to-face communication, managing expectations, time scales and understanding the technology) which could potentially cause the most concern when trying to commercialize university IP. This model contributes to both sense-making and discourse theory, along with the context of technology transfer. It contributes to sense-making and discourse theory by emphasizing the role of relationship-building places in making sense of things. Furthermore, it contributes to the context by highlighting these four areas, which are very specific to the technology transfer field in Scottish universities. It does not guarantee a successful outcome in commercialization; it simply states that if a mutual understanding of discourse cannot be made between academics and industry partners in these four areas, the commercialization will probably not be successful.

Chapter 5: Discussion

5.1 Introduction

Chapter 4 presented the findings which were based on the participants' experience of trying to commercialize university intellectual property as a TTO. Their experience was based on numerous projects which saw them communicating between academics and industry partners. The purpose of the previous chapter was to highlight the participants' experiences by interviewing them, arranging the data so it could be coded and analysed using grounded theory methods. The purpose of the discussion chapter is to revisit the research objectives and relate the findings to the literature, highlight gaps in knowledge and practice, along with illustrating contributions to both context and sense-making theory.

This chapter comprises several sections. The first is a reminder of the aims and objectives, which is followed by a summary of the findings. The subsequent sections are an examination of the findings in relation to existing research. These sections will highlight the importance of the various findings and provide further explanation of the results. In addition, the discussion section will follow the same format as the findings chapter and is examined in the same order. The structure provides contributions to the research context first which include "who TTOs work with," "awareness of the TTOs services" and "communication." This is followed by the contributions to theory which include "the dumbing down process" and "developing the relationship." The final section of this chapter will be the conclusion.

Reminder of the Aims and Objectives

The aims and objectives were originally stated in the literature review, chapter 2 section 2.12. The goal of the project explores the field of technology transfer and, in particular, to examine the strategies used to communicate between academics, TTOs and industrial partners as they try to work together. The main aim of the thesis is to understand this process using sense-making theory. Furthermore, the thesis seeks to further enhance knowledge of the commercialization process by improving practice for those involved. Therefore, the objectives of the thesis are as follows:

i. Examine TTO discourse to understand how conversation between academics and industry partners overcome problematic communication to arrive at collaborative relationships.

ii. Explore instances of noticing and bracketing during academic-industry interactions and build an explanation of the role of the mediator in this process.

iii. Identify specific contributions to sense-making theory which enrich the understanding of mediator roles.

5.2 Summary of the Findings in Relation to Aims and Objectives.

The findings contribute to both the context of technology transfer and sense-making theory in a variety of different ways which will be examined later in this chapter. The findings contribute to the context by highlighting the network of participants with whom TTOs work, both internally in the university and externally in other organizations, funding bodies, governmental agencies and businesses. Additionally, the findings highlight that even though TTO employees can articulate examples of successful commercialization of intellectual property this, in itself, does not mean that these successes influence the context in which they operate since many academics and outside organizations do not know of their existence. The findings illustrate that there is an overall lack of knowledge of offices located on the university campus which are dedicated to helping academics and surrounding industries to develop and commercialize ideas.

The findings have also contributed to sense-making theory in several ways. Weick illustrates that sense-making is the process by which we as individuals attempt to make sense of a situation. Several modes of sense-making such as sensegiving, sensebreaking and mediated sense-making have been used by scholars like Pratt (2000), Gioia and Chittipeddi (1991), Bartunek et al. (1999), Strike and Rerup (2016) as a way to make sense of, or give sense to others. All of these modes assume that sense has already been made by someone in the sense-making process. However, very little information has been paid to individuals who deliberately stop the sense-making process in order to make sense of information when sense has yet to be made. The findings have shown that the dumbing down process is a strategy which can be used to momentarily disrupt the sense-making process in order for sense to be made by others. Additionally, this is a strategy that is utilized by TTOs in order to make sense of discourse and encourage communication between academics and industry partners. Additionally, the findings illustrate that dumbing down discourse fills a significant gap in sense-making theory by identifying the TTO as the sensemaker (even though in this particular case the sensemaker is not actually making sense of the discourse but, rather,

facilitating the conversation so that sense can be made) and illustrating how the TTO stops the sense-making process, asks for clarification and then helps facilitate the understanding of discourse between academics and industry partners.

Additionally, though the literature presented by Weick et al. (2005) and Chia (2000) identifies noticing, bracketing, labelling and categorizing as important aspects of the sense-making process, little attention has been paid to who executes these steps, particularly in the context of mediated relationships such as the commercialisation of IP by TTOs. Weick et al. (2005) assumes the individual who is making sense is noticing, bracketing, labelling and categorizing the information. This is demonstrated by Weick et al. (2005) which explained by stating that noticing and bracketing is directed by mental models that have been acquired through work, training and life experiences. These mental models help the sense-maker to recognize and guide a response from other individuals in order to allow the sense-maker to notice and make sense of these other individuals conditions and circumstances. Weick's et al. (2005) description of the process of sense-making is that it is an individual experience influenced by social factors. However, what is lacking from the literature from Weick et al. (2005) and Chia (2000) is an instance where someone other than the sense-maker is noticing the deterioration particular condition and allowing others in the sense-making process to make adjustments so that sense can be made. This assumption is also demonstrated by Strike and Rerup (2016) by explaining that the mediator is the one who gives sense to others during the process of mediation. However, in the set of circumstances pertaining to this study, this is not the case. This thesis further contributes to the sense-making theory by identifying the TTO employee as the noticer, bracketer, labeller and categorizer during the sense-making process even though they are not actually making sense of the information. This means that the TTO notices there is a problem in communicating the discourse between academics and industry and then brackets the information so that sense can be made during a later opportunity. Sense is then labelled and categorized by dumbing down the information so that other group members in the commercialization process can understand the discourse that is being communicated.

Furthermore, the findings not only show that making sense of discourse can improve the communication process between academics and industry, but it can help develop relationships between these groups of people. Coupled with this finding is the development of the RRB model that identifies the key areas in which misunderstanding

of discourses can become problematic in the commercialization process. This information is based on information provided by the interviewees throughout the interview process.

5.3 Discussion 1: Who do TTOs work with?

The opinions expressed by the interviewees do further the opinions of Roberts and Malone (1996) that there is a need for universities to have a specialized unit which can help facilitate technology transfer activities. They outline these actives as providing research and development (R&D), by assisting in patenting and licencing innovations along with establishing spinouts and start-up companies. Furthermore, according to Segal (1986), universities provide a source of technical expertise for both faculty members and their students. Rogers (1986) states, universities influence the innovation process through a variety of different ways, such as scientific publications that collaborate with industry firms; training engineers and natural scientists; training PhD students by providing background knowledge, skills and personal networks; and participation in informal networking, joint R&D projects between the university and firms, research funding and contract research with an associated sharing of knowledge. Based on the research provided by Roberts and Malone (1996), Segal (1986), and Rogers (1986) there is a specific need for a highly trained group of people to help in the commercialization aspects of universities.

However, based on research from Siegel et al. (2007), which is illustrated in chapter 2 section 2.2 of the literature review, it would seem as though TTOs spend the majority of their time communicating between academics and businesses. Siegel et al. (2007) argue the economic importance that TTOs have on the businesses located within the geographical areas surrounding the universities. TTOs help facilitate commercial knowledge transfers of IP created from university research by licensing them to existing firms or start-up companies. The activities of the TTOs have important economic and policy implications because licensing agreements and university-based start-ups (spinoffs) can result in additional revenue for the university. Furthermore, by increasing additional R&D, employment opportunities for university-based researchers and graduate students can create a spill over effect both economically and technologically into the surrounding geographic location from the university (Siegel et al., 2007).

The findings extend the contextual knowledge about who the TTOs work with. The findings show that Scottish TTOs work with a wide variety of different organizations, businesses, academics, and people who specialize in legal activities such as licensing and patenting. However, the literature from Roberts and Malone (1996), Segal, (1986) Rodgers (1986) and Siegel et al. (2007), pertaining to who TTOs work with is very generalized, as illustrated in chapter 2 section 2.2of the literature review and in the paragraphs above. The findings illustrate that TTOs and their employees are very specific about who they work with and have a tendency to separate who they work with between two environments, internally within the university and externally outside of the university.

The literature presented by Siegel et al., (2007), Siegel and Phan (2005), Siegel et al., (2004), Roberts and Malone (1996), Segal (1986), and Rodger (1986) generalizes who TTOs work with internally and the findings show that TTOs are much more specific about their engagement within the universities. The findings contribute to contextual knowledge by showing that TTOs do not work only with academics inside the university; they can help facilitate and cross promote ideas between different departments and schools at the universities which otherwise might have gone unnoticed. Additionally, TTOs consist of a group of employees who are not considered academics nor are they considered businesses and often act as the mediators between the heads/deans/principals of the universities helping them to outline their commercial objectives and communicate that information back to the various departments throughout the university. Furthermore, TTOs spend a lot of time communicating with the university's legal team in order to protect not only the university but the academics as well.

Externally, the literature from the same authors; Siegel et al., (2007), Siegel and Phan (2005), Siegel et al., (2004), Roberts and Malone (1996), Segal (1986), and Rodger (1986) suggests that TTOs work with various businesses, legal advisers and other outside organizations. Each university is slightly different in who they work with externally, which might explain why the academic literature presented by these authors mentioned above is so vague on the subject matter. However, because of this vagueness, the current academic literature does not show the complexity and the vastness of who TTOs work within order to commercialize the intellectual property. As mentioned, each university is different and will more than likely have a different area of expertise such as physics, computer science, business, agriculture or brewing.

Depending upon the university's expertise the TTOs will often work with people that are specific to a particular field. This includes, funding bodies and governmental and non-governmental organizations along with businesses that work or need help in these related fields. By generalizing this information, it does not highlight the various outlets and areas in which a university might commercialize intellectual property.

Along with the university's areas of expertise, the geographical location has an important role to play in terms of who TTOs work with. Different areas may have different needs and many universities often specialize or cater their subject matter to the local economy. Additionally, TTOs might collaborate with other universities in order to help spread the cost and to utilize another universities' expertise in a specific area.

Since, the literature presented by Siegel et al., (2007), Siegel and Phan (2005), Siegel et al., (2004), Roberts and Malone (1996), Segal (1986), and Rodger (1986) is not specific concerning who TTOs work with, there is a possibility that this might hinder potential growth and development of new ideas. Specifically, in a smaller country such as Scotland, commercializing intellectual property would have a bigger impact if the information was more readily available. This study is specific to Scotland, which is small in comparison to the United States, and is the second largest university commercializing region in a high performing UK system. The UK has some of the highest-ranking universities in the world and has a devolved system supported by regional and national organizations such as the Easy IP policy which was mentioned in chapter 2 section 2.7. Additionally, United Kingdom which includes Scotland is ranked first in the world for generating commercial ideas in the world, see chapter 2 section 2.5, because of the vast networks, government agencies, funding bodies and specialized groups that can help with the commercialization of intellectual property created by the universities. Therefore, the United Kingdom and Scotland could be missing potential collaborations from around the world. Lastly, by not being specific in who TTOs work with, the literature is essentially marginalizing the TTOs' efforts in making sense of different discourses in order to communicate between multiple groups of people.

5.4 Discussion 2: Awareness of the TTOs services

The idea of a TTO is not native to Scotland or the United Kingdom. The idea started in the early 1980s in the United States, when an act of the US Congress (Bayh

Dole Act) was passed. The idea was to help universities increase their efforts in technology transfer, licensing and the development of spinout companies. Since, the inception of the act it's aims have been adopted throughout the world. Mowery and Shane (2002) state that over the period of 20 years since the development of the Bayh-Dole Act universities engaging with technology licensing has increased eightfold and university patent filing has increased fourfold. To further the point made by Mowery and Shane (2002), Colyvas et al. (2002) argue that in order to help with the increased demand of commercialization aspects on behalf of universities, TTOs needed to increase. Colyvas et al. (2002) explain that in 1980 there were about 20 TTOs in the United States. This increased to over 200 in 1990 and by the year 2000, nearly every research university had one technology transfer office located within their respective universities.

Not only did the number of TTOs increase along with developing licensing and patents, the number of spinout companies created also increased. From the period of 1980 to 2000, 3,376 academic spinout companies were created in the US (Pressman, 2000). Shane (2004) explains that spinouts, even though they are rare in terms of creation, are incredibly important to the economy. In addition, during the period of 1980 to 1999 the revenue generated from university spinoffs was $33.5 billion, which created 280,000 jobs with an average of 83 jobs per spinoff (Baycan and Stough, 2013). In 2005 alone, 628 university-based spinout companies were created and over 5,171 new firms have been launched since the act's inception in 1980. All of these accomplishments are because the Bayh-Dole Act changed the incentives for firms and universities to engage in technology transfer with one another.

The success of the Bayh-Dole Act and the commercialization aspects of TTOs in the United States have led to the development of almost all European research universities creating their own. According to Wright et al. (2007), the US model has become the standard for European countries when it comes to commercialization of any kind. Furthermore, the model has helped to increase all types of commercialization efforts throughout Europe, Australia, Canada and the rest of the world. Van Geenhuizen (2010) argues that Europeans have adopted the American ideology that the universities' "third mission" is to commercialize technology.

In the United Kingdom, policy has been created to help promote the idea of the 'third mission'. The UK government that has affected both national and regional

governments which in turn have created policy. Additionally, the UK government has expressed their opinion as to how important the knowledge creation sector is by passing legislation that will directly facilitate the knowledge-based economy. Lambert (2003) and Sainsbury (2007) have both stated that in the past several years commercialization of university-generated knowledge and technology is at the forefront of many government policies. Furthermore, to help the creation of spinout companies, the UK government helped establish "University Challenge" which is a £50 million venture capital fund sponsored by 12 government science enterprise centres.

Wright et al. (2004) argue that government incentives have helped changed the university culture throughout the UK. In other words, there is now a greater acceptance among academics towards entrepreneurship across the science departments within universities. Additionally, changing attitudes within departments and universities has led to a focus on creating spinout companies. The formation of spinout companies within the UK in 2001 represented 31% of the total spinouts created from 1996 to 2001 (Wright et al., 2002). Further information about Scotland's technology transfer environment can be found in chapter 2 section 2.6.

The findings and the information gathered from the respondents contribute to the current academic literature. The responses from the interviewees show that commercialization of knowledge and technology is incredibly important to the economy and university development. It has become a priority of several governments, generating billions in revenue for the respective countries, millions for the universities and business and created hundreds of thousands of jobs. However, what is missing from the literature from Wright et al. (2002), Wright et al. (2004), Lambert (2003) and Sainsbury (2007) is the relationship between the accomplishments (which are highlighted by the statistics outlined in the literature and shown in the paragraphs above) and awareness of the TTOs' services as a specialized group that is dedicated to commercializing activities. In fact, there is little to no scholarly literature that examines whether academics and industry partners know of an office dedicated to helping them with commercial activities. It seems that TTOs, academic researchers and universities rely on these statistics as the only form of communication and marketing of TTO products and services. This is why the data pertaining to the overall success of TTOs was written, to specifically highlight the gap in the literature that pertains to overall awareness of the TTOs' services.

If government incentives have changed the university culture in the UK as Wright et al. (2004) suggest, there should be evidence supporting that there is a greater awareness of TTO services. The findings contradict Wright et al.'s notion and add to the contextual knowledge by specifically highlighting an overwhelming lack of awareness pertaining to TTO services from the academic perspective (see chapter 4 section 4.3). This lack of knowledge on behalf of academics can have a significant impact on the universities' ability to generate revenue from commercialized intellectual property created by the academic. Furthermore, many governments around the world help fund collaborative projects between academics and businesses in an attempt to transfer knowledge between the groups. This lack of awareness directly affects small businesses, which might be losing out on generating revenue and further developing their technologies because they might not have the ability or funding to hire consultants (in this case academic scientists) in highly specialized areas as would be the case in a larger cooperation.

As mentioned in the literature review (see chapter 2 sections 2.5 and 2.6), governmental agencies spend large amounts of money per year in order to help fund universities' commercial activities. As the findings illustrate, if academics do not know this governmental funding is available to them, it begs the question 'is this a good use of taxpayer funds?' It can be argued that the government and/or funding organizations should do a better job of making their intentions known to both the academic and business communities. Additionally, some accountability needs to be taken on behalf of the universities' TTOs and their employees. Many of the respondents have shared that their respective universities do reach out and market internally to their academic staff. However, since the respondents feel that there is a lack of knowledge about what they do from their academic staff members, it can be argued that the TTOs are not doing an effective enough job in creating awareness. Furthermore, based on the findings and overall lack of awareness not only is the government wasting time and resources but so are the universities in attempts to market themselves to academic researchers in ways that are effective. Additionally, the respondents have shown that TTOs spend a lot of time, effort and energy in creating relationships with outside businesses and organizations. Nevertheless, in comparison, this is only a fraction of the resources that are used internally with academic research staff.

Furthermore, because of the lack of awareness of TTOs and their services, ideas and information are less likely to be shared with other universities, organizations

and businesses. It is well known that information can very easily be shared and accessed throughout the world because of the internet and other technologies. However, if this information is not being shared or commercialized there is a rather large potential that information might be overlooked, and opportunities might go unnoticed. This is why awareness of the TTOs' services are important because the findings highlight that when TTOs rely on the statistics of commercialized output it is not enough to generate awareness to their academic colleagues. If TTOs do not do a better job of marketing internally as well as externally, revenue can be lost, funding is wasted, and opportunities will be missed.

Lastly, as it has been argued in the findings that, often, academics do not know the best ways in which to protect their intellectual property when working in a collaborative agreement with businesses. It can be argued that the goals of the university, industry partners and academics might be different. For example, academics might believe any money coming in for funding purposes is good money. However, serval TTO employees suggest that, often, academics agree to conditions with companies that allow the businesses to keep all of the intellectual property. When this happens, the academic will not be able to publish the results, which is an incredibly important part of the academic's job. A significant part of the TTO staff members' jobs is to protect the intellectual property rights of the academic and their research. Thus, by having a lack of awareness as to how TTOs can help protect the academic, research is often being conducted in which nobody, but the company benefits from the knowledge that has been created.

5.5 Discussion 3: Discourse

The findings contribute to the contextual research by examining how communication between academics and industry partners can become problematic (see chapter 2 section 2.10.1 and chapter 4 section 4.3). This is why so many business schools around the world study the creation of knowledge management (Fincham and Clark, 2009) and their ability or lack thereof to conduct research with practitioners and then communicate these results to their intended audience. Additionally, Shapiro et al. (2007: 249) explain that this issue can be outlined as either a 'knowledge transfer problem' ('lost in translation') or a 'knowledge production problem' ('lost before translation'). Other academics argue concerning the confusion generated during the communication process and attribute this breakdown of discourse to not only different discourses, but different styles used within the scientific community (Kiser and Leiner,

2009). This means that academics and practitioners have a different way of both defining and dealing with problems. In addition, academics like Hodgkinson and Rousseau (2009) argue that discourse gaps between research and practice are to be expected and this can sometimes lead to the development of high-quality research. They state:

> Developing deep partnerships between academics and practitioners, supported by appropriate training in theory and research methods, can yield outcomes that meet the twin imperatives of high quality scholarship and social usefulness, to the mutual benefit of both agendas, without compromising the needs of either party in the relationship (Hodgkinson and Rousseau, 2009: 538).

Therefore, the primary goal for business management scholars should be working together simultaneously with industry in order to create a better understanding of how organizations work and become successful.

Hodgkinson and Rousseau (2009), Kiser and Leiner (2009), Fincham and Clark, (2009) and Shapiro et al., (2007) illustrate not only that academics should be working with businesses and organizations to create meaningful and socially applicable research but that there is also a problem communicating between the multiple groups of people. However, the findings in this study do not support the literature supported by the authors mentioned above. In fact, there are several contradicting opinions from TTO staff members as to whether communication (the understanding of discourse) between the groups is problematic. Several of the participants in this study have argued that both academics and industry partners can understand the different discourse without a problem. The TTO staff members felt this way because both academics and industry partners are experts in their respective fields and therefore speak the same discourse. Additionally, some of the TTO employees argued that they would not be putting an academic or business together if they could not communicate with one another.

In contradiction to the previous paragraph several TTO employees stated that there is a problem with understanding different discourses and this is an issue that happens on a regular basis. Even during the pilot study, there were several witnessed occasions of miscommunication and need to ask for clarification between academics, industry partners and TTO staff members. Many of the participants in the study cited

several different reasons as to why the communication process is so difficult at times. These reasons vary from not understanding the other party, to time scales and other factors which are highlighted in the findings chapter 4 section 4.6 with the relationship building model. Additionally, the relationship building model or the RRB Model was specifically developed based on TTO staff member responses concerning where the problem usually starts during the commercialization process.

There are several different reasons why the opinions expressed by TTO staff could conflict with one another. Universities that do not often commercialize intellectual property might have a smaller number of academic staff combined with fewer members in the university's TTO. Moreover, a smaller number of TTO staff members would generally mean that those staff members need to be more versed in a variety of different areas, such as legal, research, funding opportunities and commercial development. Therefore, having fewer people potentially involved in the commercialization process could reduce the risk of not understanding different discourses between academics and industry partners. Furthermore, by having a smaller cluster of academics there is a possibility that these academics are more used to speaking with businesses because they are asked to do so on a more consistent basis, versus a university with more academic staff and a larger faction of academics the TTOs could choose from. Moreover, early career academics might be more willing to collaborate with industry partners as a part of succession and career planning and development. Additionally, there is a possibility that smaller universities (in terms of commercializing) might be more specialized in certain areas and therefore the businesses that would be collaborating with those academics might be forced to find a way to communicate more effectively. There is also a significant chance that TTO employees of the smaller universities might not be telling the truth either out of fear of potentially losing their job or not wanting to admit that communication problems occur.

Larger universities (in terms of commercial output) are constantly working on a wide variety of different projects and have dozens if not hundreds of academic members of staff they might work with. Additionally, larger universities will have a larger TTO staff in order to handle the volume of potential commercial activities, along with funding and research proposals. This means that larger TTOs will have more specialized individuals in the areas of legal, commercial development, marketing and funding opportunities and will be less versed in other areas. Since, the TTO staff members in

larger universities (in terms of commercial output) are more specialized, more people will be involved in the commercialization process; as a consequence, a mismatch of personnel is more probable and there is also a possibility of miscommunication happening more often. However, without revealing the anonymity of the respondents that participated in this study, all of the TTO employees that admitted there was a problem with understanding different discourses between academics and industry were far better at the commercialization process than those who expressed there was no problem.

5.6 Discussion 4: The Dumbing Down Process

The core of sense-making theory is based on individuals trying to make sense of the world that is around them. The findings contribute to sense-making theory in a variety of different ways. For example, Weick et al. (2005) explain several modes like sensebreaking and sensegiving as ways in which we make sense of the unknown, many of which have been discussed in chapter 2 (sections 2.11.10 and 2.11.11) in the literature review. Furthermore, Weick et al. (2005) explains sense-making involves the creation of meaning. However, there is limited literature from Pratt (2000) pertaining to the modes of sensebreaking. Pratt (2000) further explains the process of sensebreaking as "the destruction or breaking down of meaning". In the sensebreaking process described by Pratt (2000), the breaking down of meaning occurs after sense has already been made. Similarly, Strike and Rerup (2016: 882) state: "the mediator helps the sensemaker to think differently about the sense that has already been made by regulating the pace of meaning making and by catalysing attention to particular cues."

The findings pertaining to the dumbing down (dumbing down is defined in chapter 4 section 4.4) of discourse contributes to the body of existing sense-making theory in a variety of different ways. Firstly, the findings contribute to sense-making theory by expanding the literature relating to the role that discourse plays in sense-making. It is argued by the researcher of this thesis that by having a breakdown in discourse, it allows for further knowledge creation and understanding to be developed from different points of view. This opinion is shared and best exemplified by other scholars such as Cornelissen et. al. (2008) and Fenton and Langley (2011), that make a general statement in which they have argued the importance of sense-making and discourse and how it can lead to interpretation and meaning production. In this particular context the TTO staff members make sense of the discourse that is used by either academics or industry partners by deliberately stopping the sense making

process. TTO employees disrupt the sense-making process when they notice there is a state of confusion from other group members. They ask for clarification until the other parties involved in the commercialization process come to a mutual understanding of what is being communicated. This momentary disruption created by the members of the TTOs allows for interpretation and meaning of the discourse to be produced in a simplistic way which everyone can understand (dumbing down). Furthermore, the dumbing down of information also provides a further example of how making sense of discourse can lead to sense being made.

Additionally, the research that is presented in this thesis adds to the existing theoretical literature by identifying particular practices which occur in relation to both sense-making and sensebreaking. This study of TTOs examines their tendency to deliberately "stop making sense" or to disrupt sense-making. This varies slightly from Pratt's (2000) view of sensebreaking, since the data here is not trying to disrupt an already established sense-making pattern. Rather, the suspension of sense-making is an attempt to revisit, revitalize or reassess the ways in which participants are making sense of the discourse. The process labelled here as dumbing down proceeds in one of the four stages mentioned in the findings chapter 4 section 4.6. Participants in the discourse are confronted by the pretence on the part of TTO staff members to be confounded by concepts, technologies, etc. In dumbing down, TTO employees deliberately feign a lack of sense-making, in order to further enhance the very making of sense. This paradoxical approach means that in order to maximize sense-making, TTO staff members periodically stop making sense. This differs from Pratts view on sensebreaking, along with Strike and Rerup's (2016) work on mediated sense-making because both assume sense has already been made. Thus, the sensemaker is either breaking down, giving, or mediating the sense that they have made to others in the conversation. In this particular instance concerning employees of TTOs, sense has not been made and therefore trying to dumb the information down is an attempt to make sense.

Furthermore, the contribution to sense-making theory is extended by introducing the idea of mediated sense-making (developed by Strike and Rerup 2016) to the literature of sense-making. The role of mediator has been overlooked by scholars including Weick as the conception is not mentioned in early adaptations and modes of sense-making. Furthermore, early modes of sense-making express the need for group members to make sense of events, but very little attention has been paid to the idea of

a third party helping to facilitate the sense-making process. It is not until Strike and Rerup introduced the idea in 2016 when the concept of having a third party or mediator help facilitate the making of sense is first mentioned. Mediated sense-making is defined by Strike and Rerup (2016; 881) as "the process and prosocial orientation through which a mediator brings forward cues and points of view to a generated pause, doubt and inquiry among actors who are sense-making within a bounded context." By introducing TTOs and their employees as mediators would also position them as sense makers. This is done by facilitating a common discourse between the academics and the industry partners. However, the definition of mediator in sense-making as described by Strike and Rerup (2016) is lacking because it is similar in nature to Pratt's (2000) definition of sensebreaking and assumes sense has already been made of the discourse used by someone involved in the commercialization process. As mentioned previously this study shows that the TTO staff member is observing confusion on behalf of the participants (either the academic or industry partner) and is asking for a clarification by dumbing down the discourse. Scholars such as Strike and Rerup (2016), along with Pratt (2000), assume that the person breaking, or mediating sense is also the same individual that is making the sense. The findings differ from the literature from both Strike and Rerup (2016) and Pratt (2000) because even though the TTO employee is noticing there is a state of confusion with at least one of the group members and is considered the sensemaker in this particular set of circumstances, the TTO is actually not making sense of the discourse. The other group members in the commercialization process are actually the ones making sense of the discourse because they are the ones with the specific set of knowledge or having a key insight concerning the problem/solution. However, the TTO acting as the mediator in the commercialization conversation allows them to ask for clarification when they notice a state of confusion is occurring. By doing this it allows other members in the discussion to make sense of the discourse by coming to an agreement and understanding which otherwise would not have happened.

Weick et al. (2005), Näslund and Pemer (2012), Chia (2000) and Magala (1997) have illustrated the process of sense-making. A more in-depth look at the sense-making process and how these terms are defined can be found in chapter 2 of the literature review section 2.11.1. Weick et al. (2005: 86) state, "sense-making starts with chaos." Furthermore, Näslund and Pemer (2012: 106) argue "if organizations are in a state of continuous flux, its members use stories as a means of making sense of

this flux." Once a form of chaos has ensued Weick et al. (2005) argue that the process of sense-making starts with noticing and bracketing. Noticing and bracketing means "inventing a new meaning (interpretation) for something that has already occurred during the organizing process, but does not have a name, and has never been recognized as a separate autonomous process, object or event (Magala, 1997: 324). Moreover, Weick et al. (2005) states that noticing and bracketing is based upon previous experience, which is guided by mental nodes. These are developed through individuals' work, training and life knowledge (for specific examples of noticing and bracketing see chapter 4 section 4.4 and in the interview transcripts which are available upon request). Furthermore, Blasco (2015) explains the generalized view that noticing, and bracketing is a critical part of the experience in disruption. Noticing and bracketing is a part of the sense-making process which involves identifying phenomena that are different when compared to the normal flux of events. This results in group members looking for an explanation concerning what has just happened and why chaos has ensued. Therefore, a new meaning, or category, must be created for the event that has just occurred "but does not yet have a name" (Magala, in Weick et. al, 2005: 441) thus, allowing group members to understand the events and to re-engage in the experience. Furthermore, Chia (2000: 517) explains that in the early stages of sense-making information "has to be forcibly carved out of the undifferentiated flux of raw experience and conceptually fixed and labelled so that they can become common currency for communicational exchanges."

The findings also contribute to the sense-making process (noticing and bracketing, along with labelling and categorizing) illustrated earlier in this discussion section and in more detail by Weick et al. (2005) and Chia (2000) in chapter 2 section 2.11.3. Weick et al. (2005) explains that the sense-making process begins with a state of chaos or a flux in the organization. In particular, the findings identify this is where the dumbing down of information by TTO staff members starts. After the state of chaos or confusion on behalf of the academic or industry partner ensues the TTO employee naturally moves on to the next phases of the sense-making process, which is regarded as noticing and bracketing.

As part of the sense-making process noticing and bracketing is discussed and further outlined in this thesis earlier in this discussion section and in more detail by Weick et al. (2005) in chapter 2 section 2.11.4. However, little academic literature has shed light on who is doing the noticing and bracketing during the sense-making

process. It is assumed by Weick et al. (2005), Chia (2000), Pratt (2000), Strike and Rerup (2016) that the person or group who is making sense is the same person or group who is also doing the noticing and bracketing. As mentioned earlier in this particular set of circumstances in dealing with technology transfer that is not the case. TTO staff members notice and bracket confusing discourse that is being communicated by other group members during the commercialization process. This is based on the TTO employees' previous work experience, knowledge and/or ability to read other group members' body language. These findings are consistent with those described by Weick et al. (2005) and do identify members of the TTO as the people performing the noticing and bracketing. The main difference between the academic literature from Weick et al. (2005), Pratt (2000), Gioia and Chittipeddi, (1991) and Bartunek et al. (1999) and the findings illustrated in this thesis is that in this specific set of circumstances the individual who is noticing and bracketing is ultimately not the person who is making sense of the discourse used by either the academic or industry partner. They are simply facilitating the conversation in such a way that mutual understanding can be made.

To reiterate, the findings contribute to the sense-making process by regarding TTO employees as intermediaries whose purpose it is to perform noticing and bracketing in a complex, multi-perspective set of interactions between academic and non-academic partners. This is done partially by examining the body language of participants and/or identifying a state of flux or chaos in group members (see chapter 4 section 4.4 for reading body language). Once the TTO employee notices there is a state of flux or confusion between the academic and industry partner, they then bracket the information in order that sense can be made by dumbing the information down later in the sense-making process. This adds to the existing knowledge by explaining how someone who notices, and brackets can help make sense of discourse (even though they are not the sensemaker) which will eventually be common knowledge for all people involved in the sense-making process.

The next stage of the sense-making process pertains to labelling and categorizing which is an attempt by individuals involved in the sense-making as a way to try and understand the experience in such a way that it can be communicated to others. Weick et al. (2005) explain labelling and categorizing as an attempt to stabilize the experience. Furthermore, Chia (2000: 517) explains that labelling workings through a tactic of "differentiation and simple-location, identification and classification, regularizing and routinization the intractable or obdurate into a form

that is more amendable to functional deployment". Weick et al. (2005) express that the key words in Chia's explanation is functional deployment. Weick et al. (2005) argues that functional deployment means developing labels on interdependent events in ways that make the information more manageable, coordinated and ease of distributing the material to others. Therefore, the ways in which situations are interpreted are immediately organized because the events are bracketed and labelled in ways for group members to gain a common knowledge of meaning.

The findings also enhance the knowledge towards the sense-making process in labelling and categorizing, as this is where the dumbing down of discourse takes place. Labelling and categorizing are explained earlier in this discussion chapter and in more detail in chapter 2 section 2.11.5. Weick et al. (2005) and Chia (2000) explains that labelling and categorizing is the stage of the sense-making process where group members try and stabilize a chaotic situation and then distribute that discourse to other group members. Specifically, Chia (2000: 517) explains that labelling is a tactic of "differentiation and simple-location, identification and classification, regularizing and routinization the intractable or obdurate into a form that is more amendable to functional deployment". Furthermore, Weick et. al. (2005) argues the key words in the statement provided by Chia (2000) are functional deployment. In other words, how do we, as individuals and actors in sense-making, process the information in such a way that it can be used by others? However, there is very little information about the different tactics which people can use in order to label and categorize the information during the sense-making process. The findings contribute to the sense-making literature by showing how discourse from either the academic or the industry partner can be dumbed down by the TTO employee so that the discourse can become "functionally deployed" (Chia, 2000: 517) or, in laymen's terms, be communicated to other group members in the sense-making process. In this particular context, TTO staff members help to establish a common knowledge of meaning to group members by dumbing down the discourse which is illustrated in chapter 4 section 4.4.

Additionally, the findings contribute to labelling and categorizing by explaining how someone in the sense-making process who is not considered an expert can help facilitate and distribute knowledge in a functional way. It is assumed by the the authors of sense-making literature (like Weick et al., 2005; Pratt, 2000; Gioia and Chittipeddi; 1991 and Bartunek et al., 1999) that the sensemaker is performing the labelling and categorizing. However, it has been established earlier in this discussion

chapter that in this particular circumstance the TTO employees are not the sensemakers because they are not the expert in the technology transfer problem or solution. Conversely, the TTO staff member is facilitating the dumbing down of discourse during the labelling and categorizing stage. This means they are helping to establish a common knowledge or understanding of the discourse even though they are not considered the expert in the field, so that it can be communicated to either the academic or industry partner. Furthermore, the TTO employee will mediate or control the conversation in such a way that group members will not move on to the next subject matter until sense has been made of the chaotic discourse.

Weick et al. (2005) argue that the sense-making process is about making assumptions. This is based on social factors which then lead to an action. These social factors include previous discussions with group members, work colleagues, friends, previous experiences, school, training and many other influences. Because sense-making is derived from many social experiences the first question according to Weick et al. (2005: 89) is usually "what's going on here?" followed by the question "what do I do next?" Furthermore, Benner (1994) argues that these types of questions create communication which is articulation. Winter (1987) says articulation is the social process in which knowledge becomes more useable because it can be communicated to other groups.

Weick et al. (2005) argues that sense-making is about making assumptions which is described earlier in this discussion chapter and in more detail in chapter 2 section 2.11.7. Specifically, Weick et al (2005: 89) illustrate that there are questions asked by the sensemaker such as "what's going on here?" followed by the question "what do I do next?" The findings contribute to the existing sense-making literature by showing, in this specific context of technology transfer, that the TTO employee is the group member in a distributed sense-making process that assumes either the industry partner or the academic do not understand the discourse that is being communicated. The concept distributed sense-making is an area that is currently under explored or not mentioned by Weick et al. (2005), Strike and Rerup (2016), Pratt (2000), Gioia and Chittipeddi (1991) or Bartunek et al. (1999). Furthermore, the findings contribute to sense-making theory and assumptions by illustrating the TTO employee as the mediator and not the individual making sense of the discourse. However, they are the individual or group member in the sense-making process who is making the assumption. The findings also contribute to the theory by adding more

questions that can be asked in making the assumptions. In this context the first question a TTO staff member asks is “can you please say that again, in more simplistic terms?” or “(what do you mean)?” Thus, dumbing down the discourse as a way of making sense of things is a process that leads to communication that can later lead to action in the sense-making process. This action is defined by further communication between the academic and industry partner along with continuing the commercialization of intellectual property.

Weick (1995), Paget (1988), Strike and Rerup (2016) have argued that sense-making is a process that happens after the events have occurred. The literature generated by Weick (1995), Paget (1988) and Strike and Rerup (2016) explains that sense-making is a process that happens in the past tense, meaning it occurs after the fact. In particular, Weick’s (1993) view towards sense-making theory is based on people’s innate drive to make sense of events that have happened. Weick (1993: 635) states “[sense-making] efforts to create order and make retrospective sense of what occurred.” In other words, this is a process that happens in the past-tense. Therefore, Weick et al. (2005) argues that sense-making is ongoing, and the process is retrospective in nature. However, there is some debate amongst scholars as to the timeframe in which this happens. For example, Weick et al. (1995) assumes speed is preferred when sense-making. Contrary to Weick et al. (1995), Strike and Rerup (2016) explore how slower sense-making helps in the process of mediation.

The next contribution to theory relates to the temporality of when sense-making theory occurs. It has been stated by Weick (1995), that sense-making is done retrospectively. Specifically, Weick et. al. (2005: 409) state that, “sense-making involves the ongoing retrospective development of plausible images that rationalize what people are doing.” Weick et, al. (2005: 409) further argue “actors engage in ongoing circumstances from which they extract cues and make plausible sense retrospectively.” However, this study would argue that the term retrospectively is confusing and misleading because these scholars disagree as to how long retrospection takes. As stated in chapter 2 section 2.11.6, Weick (1995), argues the faster we make sense of things the better. In contradiction to Weick (1995), Strike and Rerup (2016) argue the importance of a slower speed of sense-making. Everything we do as humans is retrospective in nature because it takes time to respond to and process any given situation. Therefore, this thesis argues the term retrospective is not specific enough because it could be a short or long amount of time in which the sense-making occurs.

This thesis suggests a term such as "sense-making in real time" be applied to this specific context, since TTO employees are often dumbing down the discourse between academic and industry partners as the conversation happens. By creating the term sense-making in real time it leaves very little doubt as to when the sense-making is happening and is more precise when compared to other literary examples of the term retrospective. In this particular context by combining the dumbing down of discourse and sense-making in real time leaves room for human error in making the wrong interpretation and allows for the flexibility to change and create new meaning.

5.7 Discussion 5: Developing the Relationship

For the purpose of this thesis, discourse is used as an all-encompassing term based on Fowler's definition:

> Discourse is speech or writing seen from the point of view of the beliefs, values and categories which it embodies; these beliefs etc. constitute a way of looking at the world, an organization or representation of experience – ideology in the neutral non-pejorative sense. Different modes of discourse encode different representations of experience; and the source of these representations is communicative context within which the discourse is embedded" (Fowler quoted in Hawthorn, 1992: 48).

Further definitions of discourse are stated in chapter 2 section 2.8. Fowler's (quoted in Hawthorn, 1992) definition is the basis for which other scholars have defined organizational discourse. Organizational discourse has borrowed heavily from the wider discourse literature and is similar when compared to other fields of study.

The term organizational discourse refers to structured gatherings of text used while group members are talking or writing (Grant et al., 1998; Parker, 1992; Phillips and Hardy, 2002). The group dynamics affect the language and discourse used in organizational settings (Phllips and Hardy, 2002). Furthermore, Mumby and Clair (1997:181) state that "discourse is the principal means by which organizations' members create a coherent social reality that frames their sense of who they are".

There are also different domains that are prevalent in organizational discourse studies. They include conversation and dialogue, narratives and stories, rhetoric and tropes. Each of these domains help to explain how people within a specific group can communicate with one another. For example, Eisenberg and Goodall (1993) explain

that studies of discourse in organizations have sought to show how dialogue can be used to create meaning and understanding within a specific group. Once meaning and understanding have been established in a specific group some academic scholars have argued that the discourse that is created by various groups will only exist as a part of the same conversation if they are developed as a response to each other (Ford and Ford, 1995; Westley, 1990). Therefore, discourse that is created through the organization is not the result of single events, but rather is produced through ongoing linguistic and textual exchanges between group members. The discourse is based on multiple discourses that can be the catalyst for further actions and conversations (Fairclough, 1992; Taylor et. al., 1996).

TTO employees often use many of the different discourse domains, such as conversations, dialogue, stories and metaphors. The different domains are discussed in more detail in chapter 2 sections 2.10.1 to 2.10.4. For the purpose of this thesis, the different domains are not important, what is, is how TTOs use, understand and communicate different types of discourse to other groups of people. There is plenty of literature discussing how discourse and different domains are used within organizations (see chapter 2 section 2.10.1 to 2.10.4) (Grant et al., 1998; Parker, 1992; Phillips and Hardy, 2002; Mumby and Clair 1997). However, what is lacking in the literature from these same authors is how understanding discourse can help develop a relationship. This thesis contributes to existing theory by examining how making sense of discourse used (in this case TTO employees) by individuals can help develop relationships between different groups of people. Specifically, in this context of technology transfer academics and people from different businesses and industries must communicate and understand one another in order to have a successful commercial outcome. This is why the RRB model was developed in order to highlight the specific areas in which sense needs to be made for a successful commercialization project. However, meeting these specific criteria forces group members to communicate with one another during the commercialization process thus developing relationships with one another based on mutual understanding of different discourses, therefore, increasing the likelihood of a more successful commercial outcome.

5.8 Conclusion

The discussion chapter has critically compared the findings in relation to existing literature both contextually and theoretically. First, the discussion section has helped to contribute to existing contextual knowledge by showing that existing

literature pertaining to who TTOs work with is very vague and this could hinder the potential growth and commercial output of universities. Secondly, even though there is vast knowledge about the successes of technology transfer in universities, there is very little evidence to support that academics have an overall awareness of the TTO. This lack of awareness on behalf of academic members of staff in universities could impede the distribution of knowledge and put academics at risk by not protecting their own intellectual property. Thirdly, the discussion chapter has addressed the issue of whether discourse between academics and industry partners is problematic within the context of technology transfer. The results vary on this particular subject; however, the universities that tend to admit there is a problem in communicating between these groups are often much better at commercializing intellectual property when compared to those that do not.

The discussion chapter has also helped to contribute to existing theoretical knowledge by illustrating how the dumbing down of discourse can lead to sense being made, which is different than other modes of sense-making because, in this particular instance, sense has not been made. Rather, the dumbing down of discourse not only temporarily disrupts the sense-making process but also acts as a tool which can be used by individuals in order to make sense of discourse.

Additionally, this chapter has discussed the nature of how the TTO staff members are considered to be the sense makers in this context even though they are not actually making sense of the discourse. They are merely facilitating the conversation in such a way that sense can be made. This trend continues while identifying TTO staff members as the noticers, bracketers, labellers and categorizers in the sense-making process. Furthermore, the discussion chapter has addressed the temporality of when the sense-making process occurs and calls for them to better suit a circumstance in which sense is being made as the conversation is happening, rather than simply stating retrospectively. Hence, the term sense-making in real time should be used.

Lastly, the discussion chapter has addressed the RRB model and how it can be used in order to develop relationships between academics and industry partners. Furthermore, the discussion chapter has illustrated how making sense of different discourses can aid the development of relationships between multiple groups of

people. This subject matter has previously been overlooked in the sense-making and discourse literature.

Chapter 6: Conclusion

6.1 Introduction

The purpose of this chapter is to provide an evaluation of the entire thesis by reviewing each specific part in detail. In order to achieve this assessment, a review of the overall aims and objectives will be discussed, followed by how the aims and objectives relate to the contributions of context, theory and management practice. Next is a review of the methodology chapter, which will discuss the philosophical standpoint of the author, what research methods were used and how the data were analysed. This will then be followed by the limitations of the thesis and areas for further research. The final two sections of the conclusion chapter will include a reflective outlook examining the personal feelings of the author throughout the thesis project and an overall conclusion of the work that has been presented in this thesis.

6.2 Reviewing the Aims and Objectives

Sense-making theory was used as the overall theoretical viewpoint to focus and guide this study, as those theoretical concepts and relationships have shaped the conceptual framework of this research and its questions. The overall aim of this thesis is to explore the field of technology transfer and to examine the strategies used to communicate between TTOs (along with their staff members), academics, and industrial partners as they try to work together. This is coupled with understanding the commercialization process through the theoretical lens of sense-making theory. Furthermore, the thesis seeks to further enhance knowledge of the commercialization process by improving communication strategies for those individuals and groups involved. This thesis has shown how the overarching research objectives in Chapter 1 (version 1, page 3) were refined through engagement with the literature review in Chapter 2 (version 2, page 48) and finalised on the basis of the methodological choices made in Chapter 3 (version 3, page 52). This approach demonstrates the evolution of the research questions which has been discussed in the literature (see MacIntosh et al., 2016). The final set of research objectives were:

i. Examine how TTOs overcome problematic discourse to arrive at collaborative relationships between academics and industry partners.

ii. Explore instances of noticing and bracketing during academic-industry interactions and build an explanation of the role of the mediator in this process.

iii. Identify how mediator roles can enrich the understanding of sense-making theory.

The table below will provide a systematic presentation of how each research objective was met.

Research Objective	**How the Research Objectives were met**
1) Examine how TTOs overcome problematic discourse to arrive at collaborative relationships between academics and industry partners.	The first research objective was met by identifying a specific mode that individuals can make sense of the unknown which is currently not articulated in the literature. This process is called dumbing down. This means explaining the discourse in such a way that even a layman with no experience in the particular field could understand the discourse.
2) Explore instances of noticing and bracketing during academic-industry interactions and build an explanation of the role of the mediator in this process.	The second objective is met by illustrating that TTOs employees are noticing and bracketing. Literature from Weick (2000), Chia (2000), Pratt (2000) and Bartunek (1999) do not identify who the individual is that is doing the noticing and bracketing in the sense-making process. Therefore, the mediator can distribute the discourse in a functional way so it can be used by others, even though they are not actually the ones making sense of the discourse but rather noticing a state of confusion or flux from other members and allowing them.
3) Identify how mediator roles can enrich the understanding of sense-making theory.	The third objective is met by examining how TTOs employees are third party mediators (considered as the sensemakers) and are not making sense of the discourse but rather facilitating the conversation in such a way that others can make sense of the information that is being presented. This is called distributed sense-making and allows a third party or a mediator to help facilitate the making of sense and/or distributing it to others.

Table 8: How the Research Objectives were met

Source: Own material

6.3 Research Contribution

This thesis contributes and generates original knowledge to sense-making theory in two separate ways. The first contribution to theory is extending the knowledge towards the different modes of sense-making. In particular, how to facilitate the sense-making process and give sense to others when sense has yet to have been made. Additionally, the second contribution to theory extends the knowledge pertaining to the role of a third party or mediator helping facilitate the making of sense. Furthermore, the findings and discussion extend the sense-making literature by identifying how a third-party mediator, in this particular case the TTO employee, is the noticer, bracketer, labeller and categorizer during the sense-making process. This is contrary to existing literature because in this case the mediator, or sense-breaker or sense-giver is not the individual who is making sense. The second contribution to theory examines the role of discourse in the sense-making process and how it can lead to the development of a relationship between multiple group members in the commercialization process.

The findings and discussion chapters contribute to contextual knowledge in three different ways. The first contribution to the context is furthering the knowledge as to whom the TTOs and their employees work with. The second contribution is the overall awareness, from either academics or industry partners, pertaining to TTOs and their services. The third contribution to the context addresses whether the understanding of discourse between academics, industry partners and technology transfer office employees can become complicated. If the communication between any of the group members or individuals does become complicated, this is when the theoretical contributions of this thesis take place.

The last contribution is the managerial practice. This is done by developing the RRB model which highlights the key areas in which sense needs to be made in order to have the best chance at a successful commercialization outcome. This model can be adapted and modified to better suit individual technology transfer offices and their employees. This model can also be used in other fields and areas of expertise, as the design of the model is to identify key problematic areas of communication which may arise in any business or relationship conversation.

6.3.1 Contribution to Theory

The findings contribute original ideas and knowledge to sense-making theory in several different ways. Sense-making theory is described by Weick (1995: 4) as, “the

making of sense." Waterman (1990: 41) adds to this deceptively simple definition by suggesting that sense-making is a process of "structuring the unknown." This thesis generates original knowledge to sense-making theory by identifying a specific mode that people can make sense of the unknown which is currently not articulated in the literature. This process is called dumbing down. This means explaining the discourse (in this case that is used by either the academic or industry partner) in such a way that even a layman with no experience in the particular field could understand it. Dumbing down of discourse is demonstrated in chapter 4 section 4.4 and this is the first time a mode like this has been addressed for sense-making theory. Meanwhile, other modes of sense-making suggest that the person who is making sense is also giving, breaking or mediating the sense to others. However, this study differs by examining how TTOs and their employees are third party mediators (considered as the sensemakers) and are not making sense of the discourse but rather facilitating the conversation in such a way that others can make sense of the information that is being presented. This is done by deliberately stopping the sense-making process so that others may make sense of a given situation. This is called distributed sense-making and the process assumes either the industry partner or the academic do not understand the discourse that is being communicated, thus allowing a third party or mediator to help facilitate the making of sense or distributing it to others. The concept distributed sense-making is original because it an area that is currently under explored or not mentioned by Weick et al. (2005), Strike and Rerup (2016), Pratt (2000), Gioia and Chittipeddi (1991) or Bartunek et al. (1999).

Even though scholars such as Weick (1995, et al.2005), Pratt (2000), Chia (2000), Gioia and Chittipeddi (1994) and Bartunek et al. (1999), Strike and Rerup (2016) have paid attention to sense-making there is a very limited literature pertaining to the different modes of sense-making along with the process of sense-making; in particular, who is doing the noticing, bracketing, labelling and categorizing during the sense-making process (the sense-making process will be covered in detail in chapter 2, sections 2.11.4 and 2.11.5). Sense-making theory and the different modes of sense-making such as sensegiving, sensebreaking and mediated sense-making assume that the same individual who is making sense is also noticing, bracketing, labelling and categorizing the information or discourse. However, the findings show that in this instance in the technology transfer environment, this is not the case. Rather, even though the TTOs as employees are noticing, bracketing, labelling and categorizing the discourse so it can be used by others, they are not actually the ones making sense of the discourse that is being used by either the academic or the industry partner. This phenomena is the first time this

has been recorded in relation to sense-making theory. Examples of the TTO employees noticing, bracketing, labelling and categorizing various discourses can be found in the findings chapter 4 section 4.4.

The second contribution to sense-making theory extends the role that discourse plays in sense-making. For example, Weick et al. (2005) explains that the role of discourse in sense-making is underexplored. Furthermore, the findings show that trust and relationships are very important to the commercialization of university IP. Therefore, this thesis extends the academic literature surrounding discourse and sense-making by Weick et al. (2005) and showing how making sense of discourse can help build a relationship between TTOs and their employees, academics and industry partners.

6.3.2 Contribution to Context

The findings extend to the research context is by examining to the ability to communicate, or lack thereof, between academics and industry partners. The findings add to the contextual research by examining how discourse between academics and industry partners can become problematic. The literature explains that this is why so many business schools around the world study the creation of knowledge management (Fincham and Clark, 2009) and the ability, or lack thereof, to conduct research with practitioners and then communicate these results to their intended audience. Additionally, Shapiro et al. (2007:249) explain that this issue can be outlined as either a 'knowledge transfer problem' ('lost in translation') or a 'knowledge production problem' ('lost before translation'). However, the findings of this study are contrary to that of the academic literature. The findings of whether discourse is problematic in the technology transfer environment directly contradict the current academic literature which is a unique observation that is specifically related to the context of this project. This is done by examining how individuals from different fields and backgrounds use discourse through the different domains in order to make sense of discourse which builds relationships between the TTO employees, academics and industry partners. Additionally, the concept of distributed sense-making could help address this contextual issue by facilitating knowledge and discourse to multiple groups of people.

Furthermore, this thesis examines why developing the relationship is important, what role discourse and understanding play in developing that relationship and the amount of time taken to develop a relationship in the context of technology transfer. This thesis extends the research context by examining who TTOs work with; the current literature surrounding this is very generalized. For example, Segal (1986) explains that

universities provide a source for technical knowledge for academic staff, but students also acquire experience by learning and living on campus. Rogers (1986) supports this view and suggests that universities influence the technology transfer process through a variety of different ways, such as: scientific publications that collaborate with industry firms; training engineers and natural scientists; training PhD students by providing background knowledge, skills and personal networks; along with participating in informal networking, joint R&D projects between the university and the firms, research funding and contract research with a goal of sharing and developing knowledge. This creates original knowledge to the current literature by examining who Scottish TTOs work with and this information can be seen in the findings chapter 4 section 4.2.

Additionally, the research context is observed by examining whether academics have an overall awareness of the services of the TTO. Currently, the academic literature makes it appear that everyone has an awareness of TTOs and their services. For example, both Lambert (2003) and Sainsbury (2007) state that in the past several years commercialization of university-generated knowledge and technology is at the forefront of many government policies. Wright et al. (2004) argue that government incentives have helped change the university culture throughout the UK. If government incentives have changed the university culture in the UK, there should be evidence supporting that there is a greater awareness of TTO services. However, the findings in this study show that there is very little evidence to support such claims which is also an original contribution to the contextual field of university technology transfer.

6.3.3 Contribution to Management Practice

The final contribution to both theory and context comes from developing a new model which has not been developed in other research relating to the field of technology transfer. The RRB model pinpoints the exact areas of where sense needs to be made in order for academics and industry partners to communicate effectively throughout the commercialization process. This model further enhances the likelihood of developing a successful relationship between all group members in the commercialization process. The model is called the RRB model. The RRB Model adds to the knowledge that was mentioned in the previous paragraph, which is how making sense of discourse can help in the development of a relationship between TTOs and their employees, academics and industry partners. Furthermore, the model further enhances contextual understanding to the complex nature of technology transfer as the model expresses specific criteria where discourse between academics and industry can become problematic and where the dumbing down of discourse is most likely to occur. The RRB model is based on

information gathered from the participants of this thesis, which have highlighted specific critical areas based on their experience of where potential misunderstandings of discourse can arise. These criteria include; face-to-face communications, managing expectations, meeting the time scales and understanding the technology. These criteria are all codes that were developed as a result of analysing the data through grounded theory methods which can be found in the methodology chapter 3 in sections 3.20.3 to 3.20.5.

6.4 Methodological Review

An interpretive paradigm was utilized in order to align this research with an interpretivist epistemological standpoint and an ontological view of constructivism. This thesis built theory inductively thus leading to the identification of gaps in the literature which contribute to existing knowledge both contextually and theoretically.

Following the philosophical standpoint which has been illustrated throughout the methodology chapter, qualitative research was utilized in order to respond to the research questions, along with the aims and objectives. The exploratory case study was at a university TTO in Scotland and was conducted through ethnographic research. Additionally, both field notes and interviews were coded and interpreted in a thematic analysis of the collected data. Thus, the information which collected from the exploratory study became the basis for the main interviews. This is how the remainder of the data were collected for the thesis.

The interview process lasted several months which depended mostly on the participants' scheduling. There were 16 interviews, representing 13 different Scottish universities' TTOs. The Glaserian version of the grounded theory method was used in order to analyse the interview data as it was seen as both an easier and more applicable version of grounded theory methods. Open, selective and theoretical coding were all conducted using NVivo software throughout the process. Open codes were used as a generalization in order to further sort the data. The selective codes that were used were derived from various responses from the participants which included who the TTOs work with, knowledge of the TTOs' existence, relationships and communication. Furthermore, the selective code communication was used to further the coding process into theoretical codes which included the dumbing down process and developing the relationship. Additional theoretical codes were applied to the data for the development of a model called the RRB Model which consists of four theoretical codes that are as follows: face-

to-face communication, managing expectations, meeting the time scales and understanding the technology.

6.5 Limitations

There are a couple of key limitations to this research. Firstly, the researcher was not able to interview representatives from every university in Scotland. There are a total of three universities that were not represented in this study. Unfortunately, these three universities happen to be in the top five universities in Scotland pertaining to technology transfer. Furthermore, some of these universities only have one individual who specializes in commercialization. There is, therefore, a possibility of representing only the smaller universities in the Scottish technology transfer environment. However, this study does try to negate this issue of validity and reliability by including as many individuals from as many universities as possible in order to collect the most amount of information and represent the Scottish technology transfer industry accurately.

Moreover, the only individuals consulted for this research project were those employed by technology transfer offices. In the exploratory study a small amount of academic staff and professors were interviewed on their experiences working with TTOs. However, gathering information from the academic staff proved to be incredibly time consuming and difficult to obtain because of their teaching and research requirements. Furthermore, industry partners were also not included in this research because of time restraints for the researcher and issues of confidentiality on behalf of the businesses pertaining to intellectual property.

Another limitation to the research study pertains to the TTO employees that were interviewed. All of the TTO employees gave a retrospective account of their interactions. None of the interactions were observed by the research since the main data gathering method was by interview. If the researcher has been given the ability to observe a commercialization project or multiple projects from start to finish (meaning observing several meetings between TTO employees, academics and industry partners) the findings might be different.

Additionally, the universities that were chosen in this study are geographically specific to Scotland. Other universities throughout the United Kingdom, Europe and the United States are not included in this study. Regions such as England, European regions like Germany, and Ivy League Schools in the United States, have several colleges and universities and in comparison, Scotland is much smaller. Therefore, the data represented

in this study have a high probability of highlighting phenomena specific to the Scottish region and may not be represented in other areas.

Another limitation of the research is how the data were collected. The majority of the interviews were not conducted in person or face-to-face and were conducted over the phone due to the vast distances between the researcher and the other universities. There were some minor problems with talking over the research participant when they made an interesting point and the researcher wanted to go back and highlight those subject areas. Also, when conducting interviews over the phone there is no possible way to read the body language of the individuals in the interview process so any cues that potentially might have been given were probably missed. Another issue was time constraint. Several of the participants had an extremely busy schedule due to the nature of their work and even though they were kind enough to take time out of their schedule to partake in the interview, they might have been rushed in order to return to work. Furthermore, with the exception of the interviewees from the pilot study university, all other participants were interviewed once. The combination of not being able to interview the majority of the participants more than once, coupled with the other issues that were mentioned, indicate that there is a possibility the information collected and analysed might be subject to researcher bias.

Researcher bias is another potential limitation of this study because the researcher spent a great deal of time working with the technology transfer office at a university during the exploratory study. While conducting the study at the TTO Office, the researcher became friendly with several members of staff and got to know them on a personal basis. Additionally, the time which was allocated to this pilot study allowed for a more in-depth analysis and potential findings. Therefore, there is a possibility of finding a phenomenon which works well at one university and trying to apply it to others.

6.6 Further Research

There are a couple of key areas where this study could be continued for further research. Firstly, it would be interesting to compare the data pertaining to dumbing down the discourse that is being communicated by academics and industry along with identifying both the noticer and bracketer, which was found in Scottish universities to other universities throughout the United Kingdom. Additionally, this information could be compared to other high commercialization regions throughout Europe such as France, Germany, and Italy.

Furthermore, because of the vastness of the United States further research could be applied by studying various regions such as the Ivy League school system, University of California school system, the New York school system (SUNY) and Massachusetts universities such as MIT and Boston College to see if these regions share similar attributes to those discovered in Scotland. Moreover, these universities could then be compared to various universities throughout the UK and Europe.

Additionally, there are other fields of study in which dumbing down could be applied such as in politics and the ability to communicate bills and laws to the people who are ultimately voting on them. Dumbing down also has the potential to be applied in news reporting by possibly dumbing down the information to a larger audience. The process of dumbing down information has already been used in a side project that was conducted by the researcher along with a team of individuals at the pilot study university. This project was a government funded project which was undertaken by the Manufacturing Technology Centre (MTC) and Heriot-Watt University in order to better communicate technology readiness levels (TRL) and manufacturing readiness levels (MRL) and apply them to start-up and university spinout companies. This information was originally developed from NASA and has been applied to Rolls Royce and other large companies; however, the process has never been tested on smaller or developing companies. Therefore, the TRL and MRL scales had to be dumbed down in order to make sense of them and apply them to start-up companies.

In addition, other research could be gathered either through observation or interviews with the other parties involved in the sense-making process. This would include directly contacting academics who have or are currently working with their own university TTOs to see if their experience matches with that from the TTO employees. Furthermore, this research could be extended by interviewing or observing industry partners and recording their perspectives on the commercialization process. It would be interesting to see how the other parties involved in the commercialization process feel about the TTO employee asking for clarification when and if they get the impression another individual does not understand the information that is being communicated.

Lastly, another area of research that could be developed is by introducing sense-making theory to agency theory. There is an argument that could be made that TTO employees could also be seen as agents rather than sense-makers. Agency theory attempts to understand relationships between agents and principals along with different social

hierarchies. Further study could be particularly paid to agency theory in relation sense-making theory with noticing, bracketing, labelling and categorizing. Since, it is assumed by sense-making theory that the person who is making sense of a given situation is also the person who is noticing, bracketing etc. This thesis identifies a situation where the person who is not making sense of a given situation is responsible for noticing, bracketing, labelling and categorizing the information during the commercialization process to other individuals0. Agency theory could help examine the relationship between TTOs, academics and industry partners along with identifying the individual who is responsible for various nodes of the sense-making process.

6.7 Reflective Observations

There were many aspects of this project that were challenging to me personally. During the pilot study I found it difficult to stay busy, as at times it was incredibly boring sitting in the same room with the same people trying to observe their routines and work practices. The little things which normally would not bother me became incredibly annoying. For example, the main printer for the TTO was located in our room (it was a room compiled of many people in cubicles) and it was distracting every time somebody would print something and try to have a conversation with somebody else in the office. However, it is important to note that this was a way for people to communicate with each other on various projects. They communicate mostly face-to-face instead of sending emails which might have been lost or misplaced.

Furthermore, during the pilot study it is was difficult to get people to trust me and therefore open up and communicate with me. Not all of the staff, but many of the TTO employees were reserved and the only thing I can surmise is that some of them felt that I was there to audit them or get them into trouble. An effective way in which I combated this issue was by buying donuts, coffee and tea for the employees. I also bought flowers for the administrative staff. These actions seemed to break the ice and it was much easier to interview the TTO staff members after that. Another aspect I found interesting was how an individual's ego and mannerisms can change the second someone asks to interview them for their expertise and knowledge. In one particular case an interview was conducted in the head of the department's office. The interviewee proceeded to eat his lunch during the interview, go through his boss's office drawers, never really answered any of my questions and even interrupted another interview process.

I found it rather difficult at times to organize the respondents and to get a hold of them for interviews for the main part of the study. Also, there was very little time to build up a relationship with them, as there was in the pilot study university. There simply was not time to do that. Some of the participants engaged and were honest and open from the start. With others, however, it took some time. One of the ways I was able to break this barrier was by explaining to the participants that I had conducted a pilot study over the course of several weeks, which gave me credibility in the sense that I had some idea concerning what they were talking about and I was not completely lost in the world of technology transfer. This was tested on several occasions by the respondents asking me if I knew what some of the acronyms meant like KTP (knowledge transfer partnerships). I personally believe the best way to conduct interviews in the future will be in person rather than over the phone because it is much easier to read people's body language and gauge their responses.

Throughout this project I also learned the following three things. The first is that I have a hard time seeing the bigger picture in terms of research. It took me a while to decipher where this project was going and how I was going to get there. The second aspect I learned is that it is very easy for me to feel overwhelmed and be consumed by the amount of work that goes into a project like this. I found that as long as I can break it down into more manageable parts and set myself small goals it is much easier for me to stay on task and hit my targets. The third aspect I learned is that I really enjoy conducting research. This is an aspect of the project I did not think I was going to enjoy. However, it gave me a chance to get outside of my comfort zone and forced me to learn about a field that I would have otherwise not engaged with.

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Appendix A: Summary of the field (Field Notes)

Appendix A is simply a summary of the field notes to demonstrate that they were taken during the exploratory study. Notes were taken at every available opportunity because it was unknown to the researcher what would be important and what would not. Unfortunately, majority of the notes taken during this time were not of much use. However, these notes and study various members of the university TTO allowed the researcher to narrow down who was important to interview for the main study. There were several acronyms used in summary of the field notes they are listed below.

BW= Busy work

AWP= Another person walks into the room to use the printer

TC=Teleconferencing

E= Employee

M= Manager

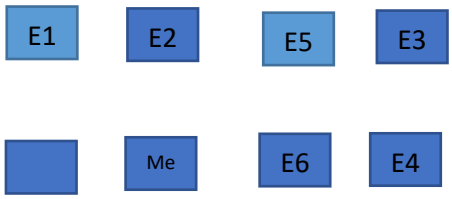
PGA= Person going away

TTO office. About 35 full time and part times employees.

Monday March 16th.

The signs to get here are misleading. In the main hall it says 1st floor, then in the stair well it says 3rd.

Table layout of where the ethnographic study mostly took place. The squares are desks and the letter E stands for employee.



Field notes

Time	Observation	Personal Reflections
9:15	Introduced myself, managed to insult someone already. Explained research.	

9.17	Got introduced to the coffee room. Met a couple of people.	It's going to be difficult to remember all the names.
9.25	Conversation is happening in the open. Something about bank statements. People are working, checking emails.	
9.35	E4 give me a structure chart of RES to understand how many employees there are.	Just reprinted an updated one – she is very helpful.
9.40	Trouble with the printer. E4 asks E3 for help – to no avail, printer sucks.	
9.43	Printer works again.	
9.44	E1 gets on the phone. Very business like conversation about event and internships. Asks to include him in an email, also offers to help find the best grads (from different uni's to help). Also makes a joke. Asks about event. Try to avoid powerpoint for seminars. (mentions) the TFF very specific jargon.	I'm finding my hearing to be very important here.
9.50	E1 conversation still going on. 18 presenters. Mention of skills innovation. Conversation – continued.	
9.52	Basic office banter in the background. Mention things about timing, especially with businesses. Conversation wrapped up. Hangs up.	
9.53	Cell rings. E1 coffee meetings	

9.55	Mentions previous event, 18 speakers. E1 tried to get people to meet and instead of a free for al trying to converse, people queued in line to talk to one another.	
9.57	Busy work. Basic convo – people walking in and out of the room for the printer.	
10.01	People are constantly walking in and out of the room for the printer.	
10.03	E2 is preparing something on Microsoft Word. Something about a meeting at 10.	It's really distracting. Got to be a better place for this thing.
10.05	I'm not sure if this is an office or a storage room. File cabinets, lockers, a make shift wall. I remember being in this room 6 months ago and it looked nothing like this. So this office is a make shift copy/printing, mail room, storage facility, break room.	It's so distracting in here.
10.15	More busy work.	
10.16	Met another person, now called E5. Just showed up to work.	I feel like a creepy stalker.
10.18	BW	
10.19	E6 phones rings, but he is not here and it goes to voicemail.	
10.21	E5 answering emails.	
	Basic office banter about a poster.	

10.22	Another person walks in to the printer.	
10.22	Everyone seems to be introducing themselves to the researchers. 'What is this guy doing' sort of thing – kind of funny actually.	This really feels like a hurry up and wait quickly situation.
10.30	Skype chat is going on – someone got a message.	
10.31	E4 phone rings. Inner office call ended.	
10.34	E5 explains he got a 19 pg CV for a research grant.	
10.34	BW	
10.40	Hallway conversation and banter.	
10.45 10.51* (may want to talk about this later)	E5 states a TTOs should be like an ER Triage Nurse. Fix it up, commercialise it, get it in the hands of the right people and then get out of the way. Another person walks in. More busy work. Another person walks in to check mail.	
10.54 10.55	E5 gives me a journal to read, specifically the article her wrote.	

10.55	E2 walks back from his 10am meeting on university bank statements. Also converses with others in the office. Everyone seems to know what is going on.	
10.56	Printer goes off again.	
11.00	BW	
11.01	There has been mention several times about the relocation/firing/leaving of employees.	
11.02	Yet another person walks in. Two more walk in to use the printer.	
11.03	Three people walk in to the printer. Now they are talking around the printer.	
11.06	Back to busy work. Emails being answered.	
11.08	Bathroom Break.	This crap is so loud, it's hard to hear and distracting.
11.15	Another person walks in and uses the printer.	
11.20	E5 on the phone.	
11.26	E1 returns, then leaves, then returns.	
11.28	E2 gets on the phone to check messages. E5 hangs up.	
11.30	Office chatter and BW.	

11.31	Birthday cards getting spread around the office for people to sign.	
11.32	Back to the BW	Hurry up and wait.
11.33	AWP	Why am I picking up on all the annoying aspects.
11.37	E1 types loudly.	
11.37	The busy work, answering emails, numbers and fact finding, seems to be a large portion of the work. But it gives them the knowledge to have a conversation.	
11.40	E5 answers E6 phone. He takes down a note of who it is and phone number.	
11.44	E6 just walked in, introduced herself. Got a full house now.	I'm officially surrounded.
11.46	E1 gets off the phone. Talking about the interns.	
11.46	AWP	
11.48	Explaining what the programs are, says someone else knows more and is willing to	
11.50	introduce in an email. Very explanatory. Great at asking questions as well as listening. A lot to do with marketing and events to go to, low cost. "Are you on business gateway?".	
11.55	BW going on.	

		Sitting in the office while people are working seems like it is going to be hard to observe language (dialogue/communications). See only one side of it and it is creepy too look over people's shoulders.
12.02	Talks about who he can contact on behalf of the client. Government helps support schemes for interns. Uses the word 'contact' a lot. Conversation wrapping up.	
12.03	AWP.	
13.39	Went to lunch.	Will have to sit in on meetings with people and see documented communication.
13.40	Back in office – is quiet, all busy working.	
13.41	E6 phone rings, wrong number.	
13.42	Looks like everyone who is taking a personal call is leaving the room.	
13.44	For the most part every ones desk is filled with files and folders and a couple of personal items – pictures, quotes etc.	
13.44	Kind of lunch hour, less people typing, more searching.	
13.48	E1 phone rings but he has stepped out.	
13.50	E? walks in to talk to E6 about something. Not important. Turns into banter.	
13.54	People are officially worried about me writing down everything.	This could be problematic in getting people to open up.

		*should bring in donuts or
13.55	People seem to like to hum or talk to themselves as they work.	muffins in.
14.03	BW. Answering emails, searching (web) etc.	
14.06	The journal E5 handed me is very useful. AVRIL.	
14.15	More busy work.	Very quiet in here.
14.17	Frustration faces look the same everywhere. On that same note, so do excited faces.	I have to admit, it's very strange observing people.
14.17	Printer is out again. AWP	
	Everyone is on the computer answering emails. Seriously, everyone.	
4.20	Seems like the main mode of communication is going to be emails, at least today very few conversations on the phone and it is very limited in terms of what I can hear.	I am going to have to be clever.
14.21	Printer is out again.	Man am I glad I have a very good peripheral vision and hearing.
14.24	Printer is out.	
14.25	Just kidding. Printer is still out.	
14.26	Printer now working…..everyone is joyful and happy.	Important

14.27 14.31 14.37 14.41 14.45	E2 goes for a lunch and coffee break. AWP. Reading my notes to pass the time. Walked around and introduced myself. Smart move, may people have identified with research. Many have suggested the hardest part of this is going to be the fact of deciding what gets communicated. People seem very nice. Legal team and marketing have a lot of conversations with academics. * process starts very early, especially for EU. UK might be different. At least for EU every aspect of innovation is towards innovation.	

Tuesday 17th of March 2015		
Time	**Observation**	**Personal Reflections**
10.00	Arrive on location at RES and had my first interview. Went well. Lasted about an hour.	
11.00	Now I've come back to the office and everyone is out except E6 who is doing busy work.	
11.02	E6 phone rings.	
11.03	Everyone comes back from a meeting. Some chat about what happened. General collective feeling there needs to be more communication and working together.	
11.04	E6 phone rings.	
11.05	AWP.	
11.08	E5 asks group how to pronounce a name.	
11.11	Someone walks in and talks to the group and says happy St Patricks Day. Has a talk tomorrow and needs help doing the admin.	
11.17	BW in the office.	
11.19	Printer goes off again.	
11.20	E4 asks E5 about how to work on something. Gives advice and E4 says thank you, goes back to what they were doing.	
11.23	E2 walks out for a second.	

11.30	Just found out I am going on a teleconference at 2pm. This should be fun.	
11.50	Meet with admin staff. They are awesome. Met another person Goodfellow. His assistant is taking me to a meeting with an academic in 15 minutes.	Man I feel so out of place doing this.
12.15	Meeting with academic discussing finances of consulting project. In this case the TTO acts as the brokerage firm between the academic and the company. They formalised the final document stating this is what the academic does, what work and so on. They also help let the department know what work has been done and try to formulate a KTP. This way it's not just one project, it can be several over a couple of year period or extend a project. The university is apparently is very good at this process and this is a priority.	Turned out to be good meeting with these people as they were interviewed for the main study.
12.30	Had lunch with E6 and E3. Good lunch. Discovered that the university TTO does more than transfer knowledge or commercialise IP. E1 helps with internships in a round about way and so does E2. Many funding schemes have a 'hire an intern or graduate' built into them. Also companies may already run at capacity and so they need help or expertise outside their realm. In addition, there is a marketing department who also help with branding,	Mentioned office is quieter because I am here.

	funding schemes and knowledge transfer events. There is a lot going on here.	
14.00	TCing into call W/E2. E2 gives background with innovation centers. Only can hear half the call. E2 now listening and taking notes. Offers contact at other universities. 'Research Themes' collaboration between universities. Seems really important, mentioned several times. Talk with innovation centers. E2 employed by SUPA, but hosted by the university.	Everyone here seems like they are very good at listening. So many acronyms.
14.24	Post phone call conversation. So E2 is an employee of SUPA which is sort of a pool of 8 units that do physics research in Scotland. They act as an intermediary for the RES (TTO's) centres. So this call was from an innovation centre looking to get people involved for projects they want to undergo. So E2 has colleagues everywhere and is now sending an email as to what SUPA does, how they can help, so on and so forth.	Let me try to wrap my head around this. E2 seems very excited about describing what he does.
14.36	E6 is currently making phone calls or returning phone calls. Mention of 'ESA' employment and support allowance.	
14.37	E5 calls and leaves a message.	
14.44	AWP.	
14.52	More busy work.	

	E6 and E3 talk about how tired they are after lunch.	
14.57	Mention of department meetings and group meetings in order to increase transparency of communication between departments.	
15.00	Back to busy work.	I don't blame them, I am exhausted.
15.05	E5 is returning phone call, asks "what would you like to see happen?". Then listens…..asks specific question, "is there anything the individuals can look at?"	
15.15	E6 is now on the phone too. E3, E4 and E2 are typing away and now the printer is going. That has got to be difficult to concentrate.	
15.18	AWP.	
15.20	Office banter, which I took part in. Now back to BW.	
15.27	Printer goes off again. AWP.	
	BW.	
	AWP. Printer goes off again.	
	AWP.	

Wednesday the 18th March 2015.		
Time	**Observation**	**Personal Reflection**
09.00	Arrive at the office, bring donuts and muffins. People ask if it is my birthday. Nope, just bringing breakfast. We have a meeting at 9.30, which I'm going to.	Was a good idea. E2 is very helpful in explaining things.
09.10	Busy work.	
09.13	Looking up RES blogs.	
09.19	BW.	
10.01	Department meeting. Kind of a 'round robin' in the coffee room. Open forum, what needs to be said in the department is said openly, conversation arises. There are a lot of acronyms in involved in this. KT, KTP etc.	Acronyms are kind of overwhelming. Apparently one guy used to keep a book but they kept changing.
10.23	M1 and M2 led the meeting. Kept it very informal, coffee or tea in hand. Tried to catch everything but that's difficult because it is so fast.	Also with accents it's difficult to understand. I generally don't have a problem with accents but because of the jargon I can't tell whether or not they are saying a word or an acronym.
10.27	AWP.	
10.35	After meeting everyone went back to their BW.	
10.37	AWP.	

10.42	Just found out these acronyms change all the time. So by the time I figure it out I've lost it. They will change it.	
10.47	Office communication about SML.	
10.49	Learning about the office politics. So left side of kitchen is for everyone, right side is for meetings (for food placement). Tea and coffee is for everyone but milk, you have to pay for that. Apparently, people steal that, so pay up if we use it.	
10.49	E2 introduced me to E7 who meets with academics and practitioners all the time.	E2 is a gatekeeper.
10.51	AWP.	
10.52	E6 walks in to start the day.	
10.55	E5 is about to beat up the printer again.	
11:05	Looks like E2 got it working again.	
11:07	AWP.	
11:12	More printer issues W/E5	If a phone rings in an office and only a researcher is there to hear it, does it make a sound?
11:16	AWP but can't because E5 is having issues.	
11:22	2 AWP complaining about the printer and conversing, making a lot of noise.	

11:24	E6 phone rings. Not here to answer it.	
11:30	Office banter between E2 and E5.	
11:35	E5 gets a call.	
11:40	AWP.	
11:45	Currently the admin staff likes me for bringing in the donuts.	
	Leaving for the day.	
	AWP.	

Friday 20th of March 2015		
Time	**Observation**	**Personal Reflection**
10.00	Arrived.	This is going to get boring very quickly. Also trying to figure out what works and what doesn't.
10.03	2 AWPs.	
10.07	Busy work.	
10.10	Introduced myself to the part time employee who works in legal dealing with patents.	
10.17	E2 just took a phone call and left.	
10.23	BW.	
10.26	E6 inner office phone call.	
10.32	E5 is currently listening away to music and looks to be typing away on a huge document.	
10.33	The hallway is a very, very active place. People are constantly walking around.	
10.36	Office banter about TV shows.	
10.42	BW.	
10.48	PGA.	
10.55	AWP.	Very quiet in here now. No phone calls, no nothing.
10.57	E2 just walked back in.	
10.57	AWP.	

10.58	AWP/PGA	
11.00	Office banter about taking a half day and entering it into the system.	
11.10	Tested the recording device.	
11.15	Came back to the office, more busy work.	
11.18	E6 won a prize or two and brought them back to the office. Something for everyone, biscuits. Very nice, a little break from the office.	Office has included me in the spam emails.
11.23	E2 is trying to sell his van.	
11.27	E6 sends me an email about feminism. Apparently, I'm a feminist.	
11.30	Lunch.	
12.30	Interview w/ED	
13.15	Went and spoke to Jeargon and asked academics from the consultancy where to find E11.	
14.00	Back sending emails to people I can talk too.	
14.15	AWP.	
14.32	2 AWP.	

14.32	Conversation with E5 took place. Told me about his job as a business development person and his feelings about the study. He is interested but feels the departments are too segregated and there isn't enough communication between them. Thinks smaller, more defined teams and more direction would help. Also expressed feeling of, really just venting about his job at the given moment. Used to spend a lot of time walking the halls, getting to know the people, because they are the product. But here at university departments are segregated and closed off. So it's hard to know what is being made.	
15.03	2 AWP. Now talking at the printer.	
15.05	Conversation w/M2. Always reserved when I talk to him. "do you have a minute? Kind of in a hurry".	
15.20	Got an interview with M1.	
15.35	Office only has 3 people in it. Most BW.	
15.41	Little office banter. E3 and E4 having conversation about someone getting audited. I'm out for the day, I'm done.	

Monday 23rd of March 2015		
Time	**Observation**	**Personal Reflections**
10.00	Arrive to the office, say good morning. Discuss weekends.	
10.03	Answer emails.	
10.05	E5 answers phone calls.	
10.12	AWP / PGA.	
10.12	E5 phone calls.	
10.13	E1 answers phone call.	
10.17	E5 continues to chat on the phone. Seems to be talking about an event.	
10.19	E5 phone call ended.	
10.19	AWP.	
10.19	Office banter which carried on for ten minutes.	
10.33	E2 takes a call. Uses several of the acronyms. KT funds for impact and outreach. AWP.	It's hard to follow along, but listening in is getting easier.
10.45	AWP.	I have to admit it seems like I am getting most of my data from interviews, but there is no way I would get
10.53	E1 answers phone, quick conversation, wrong number. E2 ends call.	
10.53		

	Set up two interviews this week, boom.	these interviews without being here.
10.59	PGA.	
11.01	E1 takes an inner office phone call, looking for someone.	
11.03	PGA.	
11.04	Busy work.	
11.12	AWP, PGA.	
11.13	AWP.	
11.16	AWP.	There seems to be a line between pushy and investigative.
11.17	M1 talks with E5. Asking for help with something. M1 is thankful. Something about a raise is mentioned.	
11.17	AWP.	
11.21	BW. Everyone seems to be answering emails.	
11.24	BW. Conversation between E3 and E5 about one of their projects. PGA.	
11.31	BW answering emails. Printer still going.	
11.34	We are having an office moment of, 'has anyone seen my stapler'.	

11.36	PGA. E5 asks if we can smell his lunch. Apparently, it smells bad.	
11.38	Looks like E2 uses social networking as part of his job.	
11.40	E1 gets a phone call (TTF), talks about the project. Lets know academic funding. Take academic funding and help develop the projects. Mostly talking about events. Conversation still going on. Mostly acronyms and pre-conceived knowledge of these acronyms.	
11.46	E3 talks to E5 about expense payments and computer problems.	
11.50	E5 takes a call, talks about a meeting with all groups involved in this email.	
11.54	AWP.	

Tuesday 24th of March 2015		
Time	**Observation**	**Personal Reflection**
09.45	BW.	I haven't made note of this because I am here – but people are constantly walking down the hallway, running into other people's offices and what not.
09.46	2 AWPs.	
09.47	Answer emails.	
09.58	Emails answered.	
10.00	Interview M4	
10.35	Interview over.	
10.37	Meet with admin staff and interview with E8 and E7. Nice.	
10.38	Went to breakfast.	
10.47	Printer and E5 are having issues again. Everyone else is BW.	
10.50	E5 calls someone. Something about patents and only filed them.	
10.54	Entire office BW.	
10.56	Phone call ended.	
10.59	People just talking about some of their projects.	
11.00	E5 on the phone again.	
11.04	Office banter about budgets.	

11.07	AWP, PGA.	
11.09	E5 on the phone.	
11.09	E2 is eating brunch.	
11.13	BW.	
11.15	E5 text message.	
11.16	PWIO across the way.	Seems like people are constantly going in and out of each others office. So I walked to three or four and asked – they all said if it's in this office they would just go and ask.
11.39	PWDH.	
11.43	PGA.	
11.47	PGA.	
12.00	Lunch.	*it seems like the real discourse is face to face and person, not the email, because you can see where the confusion lies.
13.40	AWP.	
14:00	So I set up in the hallway to see how many people are walking through the office space, maybe walking and talking to each other. Just going to do a tally mark. It is kind of comprised of the same people - does not matter if it is the same or different. Starting at 13.40 will end at 15.40. Basically leave a room and enter a room. Tally marks = 110.	One woman said she would ask her admin colleagues before asking the person who sent the email because she hasn't worked here as long and doesn't know if she should know what they are talking about or not. Basically avoiding conflict

	Note: many times it is the same person going to the same office or going to the printer. Sometimes it's a bathroom break. One person (Head of Legal) in particular is constantly going to a specific office, stays for a few seconds then leaves.	or getting into trouble. She trusts the people in her office. Good thing no one is here I am talking to myself a lot.
14.31	E2 finds me in the hallway, has a quick chat about what I'm doing. He is going up to St Andrews for a couple of days for a SUPA meeting.	Going to spend my time in the coffee room too.
14.35	Need a bathroom break.	So by making this process accidentally more awkward has caused
14.40	Back.	people to walk up to me and go 'what are you
15.15	Several people have come up and gone 'what are you doing?'	doing'. Chatting about their job.
15.30	Two people talking in the hall. Someone opened the door and now I can hear what's going on too, which is funny. When research is slightly awkward and not creepy, people will talk to you.	

Appendix B: Exploratory Case study - Ethnographic Interviews

These are a sample of the transcripts for the interviews that were conducted during the ethnographic exploratory study. The participants were coded by using E for TTO employee or M for TTO Manager, or Professor X or Y for academic staff members. For example, Interview 1: w/e 9 means interview number 1 with employee number 9.

Interview 1: W/E 9

What do you do?

Start of the funding research, when an academic wants funding they come to you and help write the application. Communicate with both academics and funding bodies. Early career funding. Help people early in their careers, older academics more set in their ways.

What do you do on a daily basis?

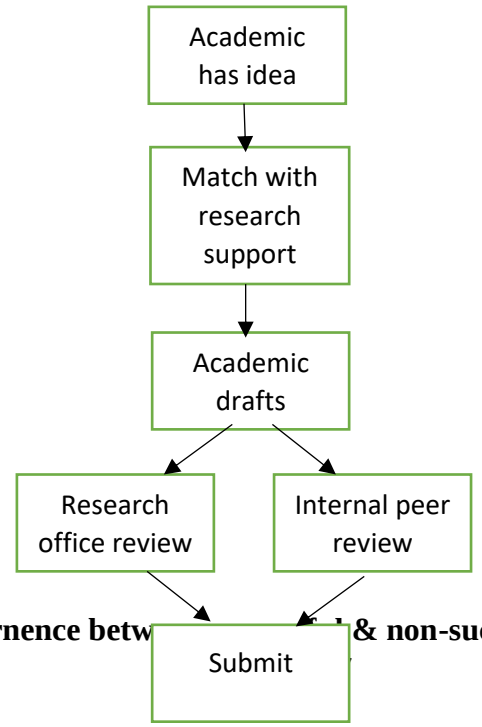
Approve apps from schools and check the apps. Meeting academics early on, that is the key. Can be difficult depending on the academic and funding.

Do you ever say it's a bad idea?

If the technology is too advanced and doesn't fit the criteria of funding. Or if the app process is bad. Don't comment on the science, focus on academic. If they can't explain the gap or the need for it, it gets kicked out. They need to explain it in laymen's terms. Sometimes I will say I'm sorry can you say that again or what does that mean. Or is this technology like this other thing over here.

How do you translate?

Two sections of the app. Science part, don't know it. Have to try and trust them. The academic side you focus on "We speak funding speak", we know the funding aspect, so translator aspect; 'Funding Speak – TTO – Academic' is passed down to the academics.



What is the differnence betw & non-successful?

Ask three questions – why you? / why now? / why the idea?

If they cant answer these then don't get funded. There are so many aspects that go into it – funding, communication, but mostly funding. Forensic approach to application.

When you don't understand, what to you do?

Answer in two or three sentences. Tell me what it is, elevator pitch. If you can't, then come back later. "identify 3 strengths" in proposal. Peer review only has five minutes and have to make the point quickly,

When the academics don't understand, what do you do?

Email wont work here. Face to face helps to try to explain. "Haven't explained the good ida as best you can, we don't question the science, we question the explanation."

University tends to leave us along unless we do something strategically for the uni. As long as the funding comes in, they leave us alone.

Interview W/E 12

What is that you do?

Contracts office for OJACK, along with other contracts. Provide contract and legal support (mostly oil and gas). Admin staff, but in Aberdeen is an innovation centre. Joint partners with funding bodies, businesses and schools.

Do you work with academics and practitioners?

Yes. So many companies.

Is there a miscommunication between the people involved?

Everyone has different ideas of who should own the IP, especially with public funding. They come to the university for expertise but many oil companies don't want to give up the IP. A lot won't work with Universities. There is give and take.

How do you explain to companies?

We are trying to build a working template for companies, OJACK, Universities and academics. If the company puts up 50% of the funding and Scottish funding bodies the other 50% then the company gets the IP and the University gets to publish. If the uni puts the money in, the uni should get the IP.

Could you explain a project that went well?

We got all parties to agree on who got publishing rights and who owned the IP. We understood their position and ours and it pretty much lined up.

The contract made things more complicated and once everything simply stated….it was very simple once that was done. The project was only a one person business, so the contract wanted a steering committee. Sometimes we send out these complex definitions and overlap.

Sometimes you have to just simply it.

How does the process work?

Application for grant award. It gets awarded and then I get involved with commercialisation, that department contacts me.

As for explaining things?

Some academics get it because they have done commercialization before. We need to know what IP are you bringing? What rights do you want? Do you want to publish? What are the results? What is the overall goal or aim of the project?

We have a number of templates and amend them. Some funding bodies already have it done and we have to follow it. Just because it's a joint project does not mean it's jointly owned. In a collaboration it often breaks down and own their own parts.

Interview w/M I

Came from handing out the money to begging for it and I'm new here.

What do you do?

Head of RES. RES is a professional service that works closely with academics. The university wants to increase the research output and funding. Both current funding and new resources and find more industry partners, cross disciplines and school boundaries. There are a bunch of specialists within RES, they are experts in a variety of fields. So there is a core staff and a staff of externally funded projects. There are also people in specific academic departments that also help.

How do you communicate with all these people?

Meet with senior staff. Wasn't a lot of communication between so staff so we have a huddle in the kitchen. And have it on different days. Between the teams. Offices don't help, I am used to open plan.

I spend a lot of time talking to the heads of the Uni, schools and departments.

Building up trust.

Do you feel independent from the Uni?

The research side of it is a very integral part of the Uni. The external funded projects is a little different. There is a lack of clarity on what the TTO does. The university rarely works across the different schools. Some departments might not like.

Are there language barriers between people involved?

There is a lot between schools. There is a lot of push back, its like herding cats at times. A lot of academics don't like being told what to do. A lot of academics don't want advice but a lot do as well.

How do you get past that communication barrier?

Work with the ones that want help. Hope they share the experience. A lot don't think we can help. Sometimes it can be a factor of time.

What direction would you like RES to go?

Bring the schools together across the schools. Strategic thread to bring people together. Corridor of closed doors makes it uninviting.

What is the process?

There is a leaflet that explains the process.

Interview w/M 2

What do you do?

Up until last year I was Head of Research and Legal and now deputy director. Help with developing relationships for funding of research. Most of funding is public funding. Manage several teams and help the schools and we apply for funding and sign off on submissions for funding. 600 proposals for funding every year and 80% is public funding. The output is conference, journal papers. A lot also comes from the European Commission as well. About 30 million per year. 90 and 140 granted for a year and about 500 applications per year. Very few multi million pound invitations.

With the legal side it's managing who owns what for the IP created. There are a lot of things to help staff and students.

Create data basis and making the information public for other people. Negotiations with funding. Manage the REF submission. Ran projects on behalf of the university. Converge Challenge, which is a project for all of Scotland.

Do you find yourself in a translator role between academics and practitioners?

Many staff have no idea what we do. People who are really active know what we do. People who are not active have no idea what we do.

Its all about getting out there and meeting everyone.

EPSRC impact acceleration account. To run activities and take research and commercialise them and put them into the public sector. A lot of work with museums as well.

How do you measure the impact?

You want to have a lasting engagement, and how do you measure that? Public engagement is easier. With other projects like a blood transfusion product you can calculate the financials, how much it saves, time etc. Have to go to the health services and get the information. Same with industry. The government is putting pressure on TTO's to measure the impact and no one else has a responsibility to report those findings. Companies often don't want to release how much they have made on a product.

How do you translate between the two?

For example the EPSRC and that group of people in RES often advise on the proposal, not on the science. What's the contribution to society? And this is how you figure out the impact and what they mean.

People in the office see proposals for specific funders all the time. Whereas academics might do it once a year. We see it every week and specialise in it. We make the proposal fit because we know what gets funded and what doesn't.

Interview with Professor X

Can you tell me about an experience with the University TTO?

I had a great research project from another university. They didn't want me to leave. The grant came with me. The university TTO helped me transfer the money, they have helped me several times and the experience has been positive.

There are aspects that are frustrating, like a paper trail that has to be filled out. That has been a learning curve. They are quick about it. The RES is the proposal stage and the grants office then manages the grants. It's up to the academic to inform RES. It's not always clear when the shift of management and who takes over when happens. The actual maintenance of the grant funds is unclear.

Who contacts who?

It's very use specific but usually we contact them. But I right now talk with RGO. Most academics don't contact the university TTO for funding bodies that might not be as obvious.

Have you ever had trouble communicating your work with theu?

With other university TTOs and HR offices were so bad I left after 13 months. They were not supportive at all. There were a waste of time and money. I don't know why would I want to give 50 percent or more of what I am making away to the university that just makes no sense. This was at another university at a basic level. It was good but past that there wasn't enough support. Here they are very willing, but in terms of staff. On the academic end is needed. RES here has some issues but overall it works quite well.

For recent terms specialists have been important with EU funding bodies. EU bodies is becoming more important in terms of funding.

What do you think RES should do in order to increase knowledge of what they do to academics?

The research active academics, they probably have enough drive to seek that out. RES could do a tour and conference once in a while to let them know. Seminar slots once in a while and research directors encourage people to go along. With email there is an information overload. Most often they simply get overlooked. It would be wise every couple of months or so to just remind us what they do. Most academics do everything at the end of the deadline. That planning ahead is not something we do. There needs to be better communication from Research Directors. Three days before a deadline we contact RES for information.

Interview with Professor Y

Experience with RES?

Standard grants I apply for and I have created a spin out as well. I have been working with the RES staff for years, I know them and they know me. We have a great line of communication and trust based on several years of experience. Staff there are great but they are understaffed. Also seems to be a high turn over of staff.

Who contacts who?

If I am submitting for a grant, in contact them first. But I also get contacted by them quite a lot as well. For the spin out company I use my own legal team, because of a conflict of interest.

Have you ever had trouble communicating with RES?

They sometimes confuse what they think we do, with what we actually do. For example, often we get phone calls from the university TTO here putting us in contact with a business looking for a marketing person. As it turns out the business didn't need a marketing person, they needed a software engineer to create a program that would be used to store marketing information, completely wrong department. There is a universal understanding that grants take too long to do. Usually the argument is over the time it takes to do.

What do you think RES should do in order to increase knowledge of what they do to academics?

Unless you are heavily involved in commercial research you won't know who they are. They are not just another level of bureaucracy. University TTO could push the fact that they can help with the impact of the research. Most people don't what they do.

I have worked with other TTO's and they are usually the same. Edinburgh is hated by the academics.

With a proposal that didn't go well?

Often university TTOs doesn't know whether or not the grant was successful. The University gets the letter but RES doesn't get informed. Every so often the university TTO contacts every academic and asks what has happened. It needs to be made clear to young academics what university TTO does. Its not our responsibility to contact the university TTO and let them know.

The university TTO needs to inform what it does to academics. RES needs more people and to expand. The turn over is very high in the university TTO. It must be difficult to work somewhere you are overworked and unappreciated by staff.

Appendix C - Main Interview Transcripts

This portion of the appendix demonstrates the main interview transcripts. In this section no data is coded or analysed according to the grounded theory analysis. However, this coding can be viewed in the methodology chapter as part of the NVivo screen shots. The letter P means the person that is being interviewed, therefore interview with P1 means interview with person 1.

Interview with P1

>> Here. It should take actually between a half an hour and an hour, so-.

>> Okay.

>> Can you describe your job, and what your job entails along with roles and responsibilities?

>> Okay, so my job is intellectual property manager, both interfacing between academics patenting attorneys and the academics who are researchers, and who are producing research deliverables. It's Marketing roles, so I'm looking for particular opportunities for the technology to go to the marketplace. And if I license then that company, I handle both routes from the contractual point if you start my job also.

>> Okay, perfect. If you don't mind me asking, how long have you been working there and how many people are in your office?

>> Our team, I'm in my 14th year and sometimes there's three and a half people in the office.

>> Three and a half people,

okay.

In terms of academics and industry who do you work with and why?

>> Well, I want the scientists who generate intellectual property of the university, for the point of view of the commercialization perspective. Not just publishing perspective. So, I'm looking at opportunities as far as their search deliverables, people, technology, transport, and that would be looking at companies that match the potential of the intellectual property rights.

>> Okay, how does the commercialization process get initiated?

>> They see technology is highlighted by the academic, by completing and discussing it with them. And if I think it's got potential we meet with patent attorney, have a look at the tangible property rights protection, and we take it from there.

>> Okay, so can you describe to me the various stages of the commercialization process?

>> There are two parts, which is getting the stuff from the labourites who IP protection to a commercialized state with tangible IP and obviously why they are acquiring it. I mean I would be looking for the academic be looking for potential licences and approaches would be made either generally or specifically targeting companies to see if they're interested on bases of saving them non-confidential disclosure at the appropriate time.

So it might be that non confidential disclosure is not has produced a patent issue suddenly down the prosecution line.

>> Okay, just out of curiosity. Who usually contacts who? Is it the academics contacts you guys or is it Industry contacting you or is it a combination of both?

>> It's usually the academics contacting us, not industry. We have got some

paths but that is not the major way it's done in this establishment.

>> Okay, and can you give me like a little bit of a flavour of what it's like to communicate between academics and industry? If you could use some examples that would be great.

>> See, I don't have any problem with the interaction between University and academics, once the technology transfer, once we start talking to industry we usually have a success for themselves. brought in to essentially not control, but be involved matching choices which usually helps it to come to a successful income.

>> Okay, what challenges do you encounter when communicating between academics and people working in industry?

>> Well it can be different expectations and different demands on academics than there counterpart or some similar in industry. So it might be that the researcher here is doing, account for differences in expectations, and so it has to be managed.

>> Is there anything specifically with the technical terminology one or the other might use?

>> No, not.

>> Okay, all right.

>> Scientists are scientists, they know the terminology. Regardless of whether

they are in industry or academic.

>> Okay, all right, so what do you do if either of the two groups are kinda not understanding what the other one is saying?

>> We have to manage to process so it is clarified. And that's one of the rules the technology transfer office can make sure that there is a match. If differences in expectations or perceptions, but this is really not scientific expectations of a scientific understanding it's the expectation of what's the sizeable deliverable management.

>> Okay, so how important is it that you understand the technological aspects of what either the academic or the industry partner is saying?

>> It's not essential, it helps but it's not possible to get some of the essential for someone at the tech transfer office to come from a particular technology discipline to understand other aspects. As long as there's a cross between the academic and the technology transfer specialist that should not be an issue there. Because the tech transfer specialist just would expect the researcher to be the mouthpiece on the technology.

So, you don't have to understand totally the science.

>> So, just out of curiosity are you kind of saying there really is no communication problems between academic and industry?

>> I'm not sure if there's not any communicational problems, I'm saying that the from a scientific point of view, it's just my experience that the both sides know exactly what each side is doing. There's more likely to be a mismatch on how technology is perceived as being commercialized between the technology transfer of the scientists and the company representative.

That's where you need to manage it.

>> Okay, so do you guys ever use metaphors or anything like that in order to help understand the technological aspects of what is being said?

>> What do you mean by metaphors?

>> So like if for example you have a scientist that is taking about the technological aspects of lasers or something like that.

>> Yep.

>> And everybody kinda maybe gets a blank look on their face of, what is this individual talking about? And you say, is it like this?

>> Well, we wouldn't be talking to people who didn't know what the scientist was talking about. We would be talking to people who understood what the science was about.

>> Okay, so you never kinda try to break it down into simpler terms or something like that?

>> Well, I would rely on the academic researcher to do that.

>> Okay.

>> But by the time we're meeting with industry we've met with some of these really coherent and it's an understanding what we're trying to do.

>> Okay.

>> So talking metaphors, no.

>> Okay.

>> I would say that's what we would do.

>> Okay.

>> We would not be talking to somebody who didn't understand what we were trying to do, we just wouldn't get an audience.

>> Okay, all right. Actually, I'm gonna write that down. Give me one second here.

>> Sure.

>> So how do academic and industry partners either assess or build the trust of each other, and is that kind of like a central part of your process?

>> And it's invariably probably with international between the company representative and researcher on the research stage.

>> Okay, and how.

>> research stage.

>> How would that happen?

>> How often does it happen?

>> No, how would that happen?

>> Well, if it was a sponsored research project then the scientist from the university would of course know his counterpart in the sponsored company.

>> Okay, does this trust play a big part in the success or failure of the partnerships?

>> Yeah, if you don't have the trust straight from the start, then it won't work.

>> Okay, and do you think it would be easy for academics and industry partners to have an initial conversation without you?

>> They invariably do, but the science and intellectual property rights technology and each university, has its own technology transfer person who has got to be involved pretty much from the start of the process, or it just ain't gonna happen.

>> All right, do you think it would be easy for academics, sorry, already asked that. Once both groups have met, do you feel it is necessary to continue to be involved in the communication process?

>> Well there's no office that wouldn't monitor it. And other offices they would work very closely on trying yeah, benefit. This office, we would monitor and insist that when happening, we'd hear about it.

>> Okay.

>> All right. What do you think industry partners or academics should be doing or should not be doing in this process?

>> Well, it's what you engage with one partner, they shouldn't really be talking to anybody else until it's exhausted the potential commercialization and the cross potential partnership.

>> Okay, and what do you think you should be doing in pertaining to your job role?

>> We can share the confidentiality agreement, the text of the confidentiality agreement, adhere to that no more that is require to take stage is divulged.

>> Okay, what do you think it is crucial part of the success to the commercialization process?

>> You've got a complete match between the microphone and speaker, simple as that. So, the application process if you like has gotten to be spot on for adult to work so everything falls into place and all your ducks in a row. So you gotta have your willingness to what the company to support any company to change that stack to devote time to a company so they produce what you what your assigned to do.

It's about making sure intellectual property rights are covered so that patent applications must be good. But just must be a general willingness toward the combinatorial team to work together.

>> Okay, and how do you measure the impact?

>> Well it's not always tangible results. It may be on impact of the dealers obviously. when deal is done. But the financial side to that, but it's also a non-financial side to things more than just a financial deal. It might bring a continuation of working together which might augment that knowledge transfer process.

>> Okay, and just out of curiosity, is there anybody else at St. Andrews that you think I should maybe be talking to?

>> Well, no. I give you specific position from university standards in a small office so no. It's fine for me.

>> Okay, perfect. Just to let you know, that was all the questions I had asked. I needed to have asked.

>> Okay.

>> So that's pretty much it Alistair. I appreciate you taking the time and helping me out here to.

>> That's all right.

>> Yeah, it's a piece of cake and hopefully I can put together in the price of fairly decent public ratio aspect of this.

>> [CROSSTALK] I'll tell you what I've structured. [INAUDIBLE] Due to crisis as well as someone on a congregation but yeah, it's a like in tough game technology transfer and you call it processed [CROSSTALK] .

>> Yeah, I noticed that one, I did my observational study at Heriot Watt, I was kind of amazed at the amount of time it takes to just get one project done.

>> Yeah, you totally underestimate amount of time it takes to pull a deal together. So I don't question [INAUDIBLE] along, usually twice the length in time to retake the course. [LAUGH] Now don't quote me on that. Right, okay, [INAUDIBLE]

>> Thank you very much, Allister.

>> Okay, thanks.

>> Bye bye.

>> Bye bye.

Interview P7

How can I help you?

>> All right. I am gonna let you know that I am recording this. But I'm not gonna be asking anything specific in nature to where it would affect your job. And it will remain anonymous when I do my thesis and if I publish anything.

>> Okay. What happens to the recording?

>> I will have complete control of that recording and then once my thesis is done it will be deleted.

>> Okay. That's fine, so you use this for the purpose of discussing-

>> Yes, that is all I'm using it for, there will be nothing else because if that's the case, then I would be violating my own contract with the university.

>> Okay.

>> And you said, sir, paying my bills, I don't really wanna do that. To give you a little bit of a heads up of what I am doing just so you know, is the whole idea and point and purpose of this is to figure out how your offices communicate between academics and industry.

So that way I can kinda put together, like, a how-to of what works, what doesn't, what needs improvement. Yeah, so on and so forth.

>> Okay.

>> Originally, the study was supposed to be an ethnographic study, but because of time constraints that didn't necessarily go to plan. So we're now going down to interviews, specifically in the commercialization side of things.

>> Okay.

>> All right, so the only people that will ultimately access to this, I shouldn't say this, the only people that would have access to this are me and my advisor. And ultimately the file will be recorded and saved on my hard drive and nobody else's.

>> Okay, and your advisor is based in the university I think.

>> Yes, my advisor is actually the Head of School of Management in Languages at Heriott Watt. So, Robert McIntosh.

>> Okay. So if you don't mind, I'll just get started with it. There's about 18 or so questions and it shouldn't take too, too long.

>> Okay.

>> Okay, no more than an hour. Most people, it's about half an hour, 45 minutes.

>> Okay.

>> So, how many years have you been working at the university in this position?

>> One.

>> Okay.

>> But, it is my second start with the university, so I was here before for a period of three years.

>> Okay.

>> In this particular university.

>> Okay. In a similar owned.

>> Perfect.. And did you work at another university during that time off?

>> No.

>> Okay.

>> No.

>> Cool. And how many people do you currently have in your office?

>> As in responsibility for it or the total department that we're manning?

>> Go with both.

>> So the total team is approximately 25.

>> Okay.

>>In my particular team is 8.

>> Okay. And can you describe to me what your job entails along with any roles or responsibilities you may have?

>> Yeah, so the agreement of the department that I am part of is to generate revenue, to help generate revenue from research, commercialization, academic team. And what we understand on the is the research that is relatively clear on the commercialization piece. What we mean by that, is what we call academic led commercialization activity.

And that covers such things as non-SFC funded training over development.

>> Mm-hm.

>> Consultancy, etc., type of activity.

>> Okay.

>> My particular role in my team deals with the pre-award side of such activity. So anything from, any leads that we're picking up from our business development people or from academics internally that need to be processed to a proposal we take on. Whether that's research or non-research type commercial activity.

>> Mm-hm.

>> We take that to the stage of a completed bid for submission.

>> Okay, nice. So who do you work with and why?

>> So our, are interfaces with slightly different for different types of activity. If we look at the research piece first, our interface there are predominantly internal. And mainly, I would say the academic community plus the number of the support departments that this has been in, developing bits.

>> Okay, perfect.

>> And on the non-research side that we support, the team has contact with the internal community, the academics, finance, particular. And also with the client who are asking, or who we're submitting a proposal for funding to.

>> Yeah, all right. So how does the commercialization process get initiated?

>> Through a number of routes. So we have a business development team, so they will go out to try and drum up business. In this type of business is predominantly delivery of training and education type of thing to corporate entities in particular. And we also have leads through academics in the organization, either people with a specific remit to go out and develop business.

We have few of those that fit in the schools or the faculties. Or people that not necessarily have the remit but actually do pick up, I've taken opportunities and will ask us to progress those. The third route is repeat business. Clients that we've already worked with, will come directly to us as a support team. And then will route this through us and then we will check with the academic that what we're asked to deliver is possible to deliver and in the time scale.

We have also within our team, and this is not part of my agreement, but in our team we also have one person who is basically IP manager. And his wall is closer to, I guess to a tech transfer time role, where we're looking at commercializing the output research through licensing and spinout activity. We do support that from the wider team, as well. But that for us, at the moment, is not a huge revenue generator.

>> Okay.

>> We have a number of spinoff companies that we've set up.

>> All right, and can you describe to me the various stages of the

commercialization process?

>> Yeah, so we looking at different types of work. So, where we submit proposals for non-research work to clients. We, at our end, look after the proposal development possibly together with the data business development team to make sure that we address the needs of the client appropriately.

We will work with our internal people, the academic staff will make sure that we get the delivery, get the proposal right. We get the content of the proposal right in relation to delivery in the practical aspects of delivery. Once we're comfortable with having a good proposal, we have an online authorization process internally where people sign off on the final aspects of the proposal where people, where somebody signs off on the resource side of the proposal.

And somebody signs off on the overall risk of the proposal.

>> Okay.

>> And when the proposal leaves the door, until such time as we hear back from the client. That's what we do. On the, I guess, the stage of commercialization where you talk about tech transfer, it's slightly different when we have different particular research outputs that are commercializable. We will try and make the outside world aware of that.

Or if it's embedded in an existing contract collaboration agreement with the party, we will negotiate with them if they are interested in taking up a license, to have ongoing access to outputs from a collaborative piece of research work. So that follows a slightly, slightly different route and has, however, similar types of approvals in place so when we get to the delivery stage, all our work will go through a complex process where again we have agreed sign off in place, and that process is also online.

>> Okay, and can you give me a little bit of a flavor of what it's like communicating between academics and industry?

>> It depends. I think the challenge is, on the positive side, I think there is a group of people that are academic staff and are very good at dealing with industry directly and also keeping us informed of their doings. So that should be a relatively straightforward process in the sense that we can stay into the conversation as sort of a team, work together to develop proposals particular.

Where we're challenged sometimes is that there's opportunities that people go off and develop on their own. That's less good for a variety of reasons. The quality of the work isn't always as good as it should be, the quality of the work in sense of the proposal, and we have a fair amount of retrospective work to do.

I think there's different levels of energy are required, I think, depending on how experienced people are working with third parties and with commercial clients. So, it's kind of, there's no easy answer. I think a lot of it is about, what's the word, looking at how well people interact and if they do that well, then just let them get on with it.

You make the best use of resources is the way I approach, because in terms of generating the right in terms of revenue requires huge activity levels in support teams like ourselves. So, we try and use all the resource available. So, we almost look at it on a case by case basis.

If we're comfortable with the academic staff often, and almost to the point where they can negotiate with the companies themselves, we let them do that. So, we try to almost delegate particular bits of activity, so we work with delegated authority in the commercial sense for some bits of commercial work, where we're confident that the academic staff I guess can be trusted, for want of a better word, to adhere to the governance that we have in place.

And that way, we deal with challenges that we have. So have I given you a flavor?

>> Yeah, a little bit.

>> It kinda sounds like a, at times it can be very difficult and challenging, and it just kinda all depends upon the situation that you're in.

>> It does, and I think that the key of it is to make best use of available capacity in the organization, which requires that we [COUGH] I guess also do trust other people to get on with some of the activity. Staff should liaise with our clients or potential clients because they're the ones that develop the content of the proposals.

So it's really a case by case basis, and building relationships so we actually know that [COUGH] people keep us in the loop for the essential part of the negotiations or the contract.

>> Okay. And what challenges do you encounter when communicating between academics and people working in industry?

>> I think the language, so being able to articulate something personally, that I think is a challenge that we're trying to help address, is to get academic staff to articulate how their field of expertise connects with how their work relates to the clients. It requires listening to the clients first, then responding to what their problem is.

So nothing revolutionary. I think it's just being sensitive to the situation of different parties and sort of different language that they speak and trying to identify where the contribution is that we can make.

>> Is there anything specifically in dealing with the technical terminology one group might use?

>> Yeah, I think it's part of it, I think it is the technical. I think it's the level of detail more than anything else, the way the problem is approached, rather from the solution point of view. Trying to think about what solution to a challenge is, versus putting amount potential solutions forward which may not exist.

So it's not necessarily about the use of technical language. I think it's more about ways of thinking and trying to, in a sense, a person's and understand where they're coming from.

>> All right. So what do you do if you don't understand what either of the two groups are saying?

>> [LAUGH] I will ask how, I'll try to establish or try solve, quite a good question. What is the problem we're trying to solve, before we actually start throwing potential solutions at things. Really just clarification and getting people together and facilitating, more than anything else, dig a bit deeper. I think we do it in most environments where you bring people together and just try and understand each other and try to understand what the real challenge is personally what I also try and look at.

Listening to other parts of the conversation and trying to understand where potential opportunities may be. But yeah, just those sorts of things, exploring and thinking a bit deeper and getting people together.

>> Okay. And how important is it for you to understand the technological aspects of what either the academic or industry partner is saying?

>> It depends in the sense that, if I'm part of a conversation and the client and we as the solution provider, or our academic staff speak the same language and there's chemistry there. Then it's not so important that we understand it. But if something is missing, then it does become important in terms of helping with the translation of the problem and towards the solution.

So it depends a little bit on the circumstances and the people involved, from whether it's important community on a scale with relatively unimportant to quite important. But as a relatively small team, we tend to deal with quite a wide range of subject matter, and we do need to be a little bit dramatic about the level of detail and technical understanding that we can achieve.

>> Okay, so how do academics and industry partners either assess or build trust of each other along with your services?

>>I think to extend in the same way that you would do it in another business by, you know, delivery as the key piece of it. You don't always get to that stage easily, but delivery is the best way to show that you can be trusted to do what

you say.

But the stage before that is very much about being responsive and answering questions, providing real answers, rather than sort of holding answers, holding positions and such. So and you know we find quite a bit of what we do is based on promotion.

>> Mm.

>> By people who have worked with us, so. Which we find quite a good way of getting positive promotion and positive PR out of what we do. We do have a good name. We have the university, also one of our approaches is that the great majority of students spend a lot of time, a significant portion of time, in industry on a placement as part as their undergrad at least, so that sort of translates in companies having experienced working with us even before we had trained any sort of formal revenue generating activity.

And depending on the experience that companies have had with a particular student, that's a really good way to build trust.

>> Okay, cool. And does trust play a big part in the success or failure of these partnerships?

>> I would say it does play a big part in it. Financial aspects are important, but I think people want to be comfortable. We do work on a number of fairly substantial contracts, and the client wants to be comfortable, but they're working with securing the contract is one thing once the contract was signed off and do something completely different and that sometimes takes time so we do spend and invite people over any time with us and spend time with them and show them what we do and engage and get them to speak to the staff but also to students and to alumni just to get a broad view of what we are like as an organization and how we operate. They get it from different angles. One way we've used that is when we get visitors on site from outside the U.K. As we often do. We try and give them some exposure to students and staff and alumni from their country.

So that gives them an opportunity to sort of, if they wanted to go offline in their own language and talk a bit about what we're really like, so that I think is quite a

powerful aspect of relationship building I think. Kind of difficult to measure what the impact is but we do get a lot of positive feedback from that particular project we have.

Prospective clients aside.

>> Okay, perfect, And do academics know what your office does?

>> Wow, that's the $1,000 question.

>> [LAUGH]

>> I couldn't say out of my heart that you wouldn't cuz that was a definite yes. The people we work with regularly yes and we do go to quite great lengths to engage with people to give the opportunity to engage, we have sort of a drop in sessions.

We do, we offer information sharing sessions with schools or faculties to let them know what it is we do and ask questions. And at the end of the day, a lot of this is about actually having worked with people. So once we have worked with our internal clients, it becomes a lot easier. Until that time, that is sort of, I suppose, theory.

>> Mm.

>> Makes it difficult to judge whether we've got our message across or not.

>> Okay.

>> So, yeah, I would say, certainly, we're certainly conscious that we on a continuous basis need to, need to share information about how we can help. The only thing when we hear we're for help. So people that use they don't use it because they prefer it down the line.

So we don't want to be in the way, but we feel we add value, but sometimes it can be challenging to articulate that value.

>> If it makes you feel any better, just about every school has said the exact same thing.

>> Yeah, it's a common thing at this sector, and I think it is very difficult to sort of be the, be the guardian of that governance peace. And we probably know we have value but by deferring nature the fact that the local's business is deadline driven, there is real threat that you can become a bottleneck.

And that goes back to the point I made earlier. Is that we are trying to build capacity elsewhere, were we're confident that the right prices is being followed.

>> Okay.

>> So that way we can focus on particular type of we feel we need to focus on. And what people think of it all, without losing sight of the activity and go with it.

>> Okay, do you think it would be easy for academics and industry partners to have an initial conversation without you?

>> Yes probably well. I have to say I was quite interested in an initiative that I think Edinburgh has made me aware of through their, their development team

where they used a model, but it's really an approach to an industry to engage with academics. And what it is, they would put out a call to have a session around, and I'm loosely translating this, I'm doing it off the top of my head, but I think it's lets say around materials.

>> Mm-hm.

>> And they would invite companies to put problems to the university that relate to materials in the wider sense, so it's deliberately quite open and from the internal community they would bring academics, that may have not have or may have the knowledge to talk about the problems being put to the organization.

And that would just create a very, very open forum to discuss challenges that the industry is facing. And that seems to be very productive for two reasons. One, it builds I guess relationships between industry and academics. But the other interesting spin off for the university was because they're such a large organization and a lot of academics don't speak to each other or for reasons that they don't have to, it actually seems to build some internal collaboration as well, because they bring such a wide range of internal expertise together.

That everything here everyone has something to contribute in relation to materials, it invites it along, it does build internal collaboration as well, so going back to your original question, I do think there is merit but it needs to be, it does need to be structured. And I think also it may require a knowledge of how we can deliver and how we can support particular types of collaborations when we move to the next stage.

So I think they are certainly merit, and I've seen many, many occasions where it's almost a chemistry between people that think whether the collaboration is going to happen and be successful, less so than to map a problem onto a particular expertise in university. It is a successful preparations to a large extent, a people's business.

At the level we're operating at, certainly in the sort of mid-sized collaborations, a couple of hundred thousand pounds, it is about people’s chemistry.

>> Sure, that makes sense.

>> That answer your question? I'm not sure I have.

>> Yes, no, you have actually.

>> Yeah, okay.

>> And once both groups have met and there's kind of a dialogue going on, do you feel it's necessary to continue to be involved in the communication process?

>> No, we take on a case-by-case basis. Again, it goes back to whether we are confident that whoever, on our end, is involved in the discussions will keep us informed and keep us in the loop because we know that in order to deliver on a piece of proposal it is important that we stay involved.

So we know there's people that are experienced collaborators and experienced in delivering for corporate clients or delivering competent research whatever it is. We, in a number of cases, just let them get on with it because we know they've done this several times. And know which stage they need to come back to us and we can trust them to do that so just where the trust piece comes in that.

>> Okay, perfect.

>> Can we add value, can we help to bring home a contract, and if we feel that to do that we need to be coached with then we'll certainly do that. But if we trust it can be done essentially without us being there all the time, then we're also quite happy to let go.

>> Okay, that makes sense. And what do you think industry partners or academics should or should not be doing?

>> In terms, in relation to-

>> In-

>> In the context of collaboration?

>> Yeah.

>> What they should not be doing. What they probably should not do is what they should be doing, is spend enough time to just make sure that the pieces work they're embarking on is useful, because the priorities, certainly as an industry, and certainly as a small industry, do change and are flexible sometimes, and not by rushing into things.

We should dig deep enough and make sure that there's commitment. So spending a bit of time getting to know each other. So what not to do is to rush into things.

>> Okay.

>> Certainly one of them. And also would not be able to think is to avoid that industry and academic smart. We want to make sure that people are commissioned to work, people who ultimately deliver, do get to be part of the conversation at an early stage.

>> Makes sense. And what do you think you should or should not be doing pertaining to your job role?

>> Tying into the I feel very much that it is very versatile. One aspect is communication and bringing the right people together, it is being from the people internally whether we actually work with them at a particular moment in time, whether they're engaged in, or involved in, staying intuned with what they are doing pertaining to their research or commercial.

Stay involved and stay tuned with what they are working, what they are doing. So not knock ourselves up, but get out there. I mean, be in front of people and create accidental meaning.

>> Okay, and what do you think is the crucial part of success to the commercialization process?

>> Quality of the history.

>> Hm.

>> And quality throughout, probably. Given that we're generally not the keeps people from I think we need to make sure that we…It's probably all the way through to the process of engagement. But certainly once you start levelling and start getting in front of a wider audience, find…

>> Okay.

>> …that's where a lot of the feedback especially for attention for negative feedback.

>> Okay, and how do you measure the impact?

>> Of what we do?

>> Yes.

>> The short answer is we don't.

>> Okay.

>> The longer answer is that we try. So we do, we do get the feedback. I mean, the repeat business, duration of some of the programs. We've got programs going on. Clients that have gone on for ten years. That's a good sign. We know that it has an impact.

Some of the impact here we can look at, training people. It is quite difficult to measure. And it actually takes time. An example would be leadership training. Be years and years down the line. So once we see people we have trained start assuming leadership roles, appearing in leadership roles, we know we've done a good job.

So we do all the things that everybody does, it's trying to capture Immediate feedback of course.

>> Okay.

>> That works, but on research I did slightly different and again given the focus that there is on impact we're certainly looking inclusively and building that into our process. Of writing the proposals to make sure that it's you know your objective is to actively seek impact and that works piece whether it's research or other types of commercial activity.

It's just difficult to establish the short time scale sometimes whether we achieve that impact or not.

>> Okay, and is there anything else you would like to add?

>> No, other than when you're working for the you feel you want to have another chat. Please do.

>> Okay, oh thank you. I appreciate that. Cuz only-

>> Please do.

>> Okay and to let you know, I'm gonna stop the recording now.

>> Okay.